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Devoted to Commercial and Naval Motor Vessels

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DIESEL MARINE ENGINES
FOR ALL CLASSES OF SHIPS

Mc INTOSH & SEYMOUR CORPORATION
AUBURN, N.Y., U.S.A.

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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

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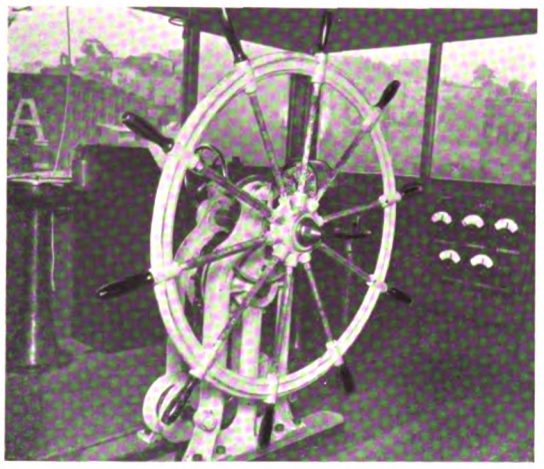
Golden Gate Diesel-Electric Ferry's Maiden Trip

Details of the First of Two Pacific Werkspoor-General Electric Propelled Vessels

INDEPENDENCE DAY was to have seen the placing in service of two Diesel-electric driven ferry boats, one on the Pacific Coast and a smaller one in Eastern waters, but unfortunately a mistake had been made in the size of the propellers of the boat for this Coast, so her delivery was delayed for a short period. But everything went well with the Diesel-electric ferry on the Pacific Coast so July 4th saw the initiation of the first ferry to have this class of propulsive power. This vessel is the "Golden Gate." She is the first of two similar vessels built for the Golden Gate Ferry Company of San Francisco (Avon J. Hanford, president and general manager), and her duty is to transport passengers and automobiles from San Francisco across the Golden Gate to Sausalito. En route from the Robertson Shipyard, where she was built, she took the opportunity to circle clear around the Southern Pacific Company's big steam ferry "Santa Clara."

The "Golden Gate" is 220′ long o.a., 215′ long w.l. by 60′ breadth o.a., 36′ breadth md., 18′ moulded depth and 11′ 6″ loaded draft on a displacement of 1,000 tons. She has a carrying capacity of 85 to 90 automobiles and 600 passengers so is quite a noteworthy vessel. Her power equipment consists of two 6-cylinder 4-cycle type Pacific-Werkspoor Diesel engines, 14.960″ bore by 23.622″ stroke, each developing 525 brake h.p. at 225 r.p.m.



Interior of one of the pilot-houses of the "Golden Gate."

Each engine drives a main 360 k.w. 225 r.p.m. 250-volt shunt-wound generator and a 35 k.w. 225 r.p.m. 115-volt compound-wound exciter. The generators are connected in series and supply current to the bow and stern driving motors, which are each 750 h.p., 145-180 r.p.m. 500-volt shunt-wound. This is General Electric equipment and driven by direct current. Operating at a constant voltage of 115 volts, the exciters furnish power for the lights and for various small auxiliary motors, such as those for the water-circulating pumps, oil lubrication, steering gear, etc. The main generators operate at a variable voltage, ranging from 0 to 500 volts, determined by the controller, enabling variation in the speed of the propelling motors. By use of the controller the voltage can be reversed, also the direction of rotation of the motors. This plant gives the vessel a speed of 12 knots.

The electric power thus generated is transmitted to two independent electric motors arranged one at each end of the boat, and it is possible to turn the bow screw at a slower speed than the aft propeller.

Heretofore the common arrangement has been to connect the driving engine to a continuous shaft having a screw on each end, one at the bow and the other on the stern, obviously making it necessary to turn both screws at the same revolutions. When the "Golden Gate" starts full power is used on both screws, but as the vessel gets under way the power absorbed by the forward screw gradually reduces, while that of the after or "main-drive screw" increases until at full speed the after screw is supplying the entire thrust and turning at 180 revolutions per minute. The forward screw then is absorb-

"Golden Gate," a new Pacific-Werkspoor Diesel-electric ferry-vessel

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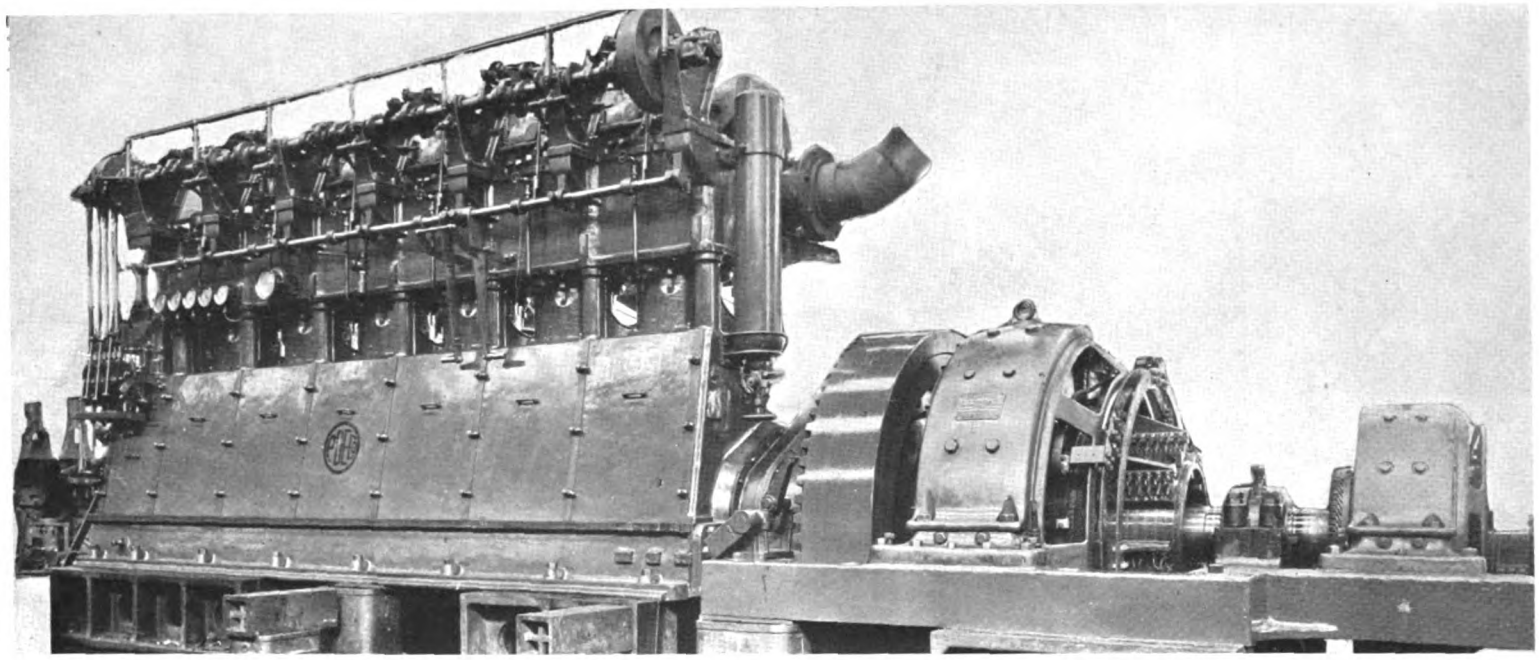


One of the twin 525 b.h.p. Pacific-Werkspoor General Electric generating units of the "Golden Gate."

ing only that power necessary to overcome the friction resistance of the propeller blades, shafts and glands and friction and windage losses in the motor itself. This amounts to about 125 horse-power and the forward screw turns at 130 revolutions per minute.

The gain in power from doing away with the continuous shaft and reducing the load on the forward screw is estimated at 20 per cent. F. L. Du Bosque, in a paper entitled "Speed Trials of a Screw-Propelled Ferryboat" (Vol. 4 Society of Naval Architects and Engineers), states that the trials of the ferryboat "Cincinnati," a vessel with a usual speed of 11 miles an hour, showed that it required 20 per cent. more power to propel the boat with two screws than with one, while if the same power could be put into one screw at the stern the increase in speed for the same power would be from 11 miles an hour to 11.53 miles. Put in simple words, the Diesel-electric drive allows the forward propeller to turn over just fast enough to keep up with the speed of the boat without doing any additional work.

Although the "Golden Gate" was used to handle some of the holiday crowd on the Fourth of July, the vessel was not fully completed and was sent back to the Robertson shipyard in Alameda for finishing. Complete trials to determine the data necessary for the most efficient operations are to be held about the time this issue of MOTORSHIP goes to press.

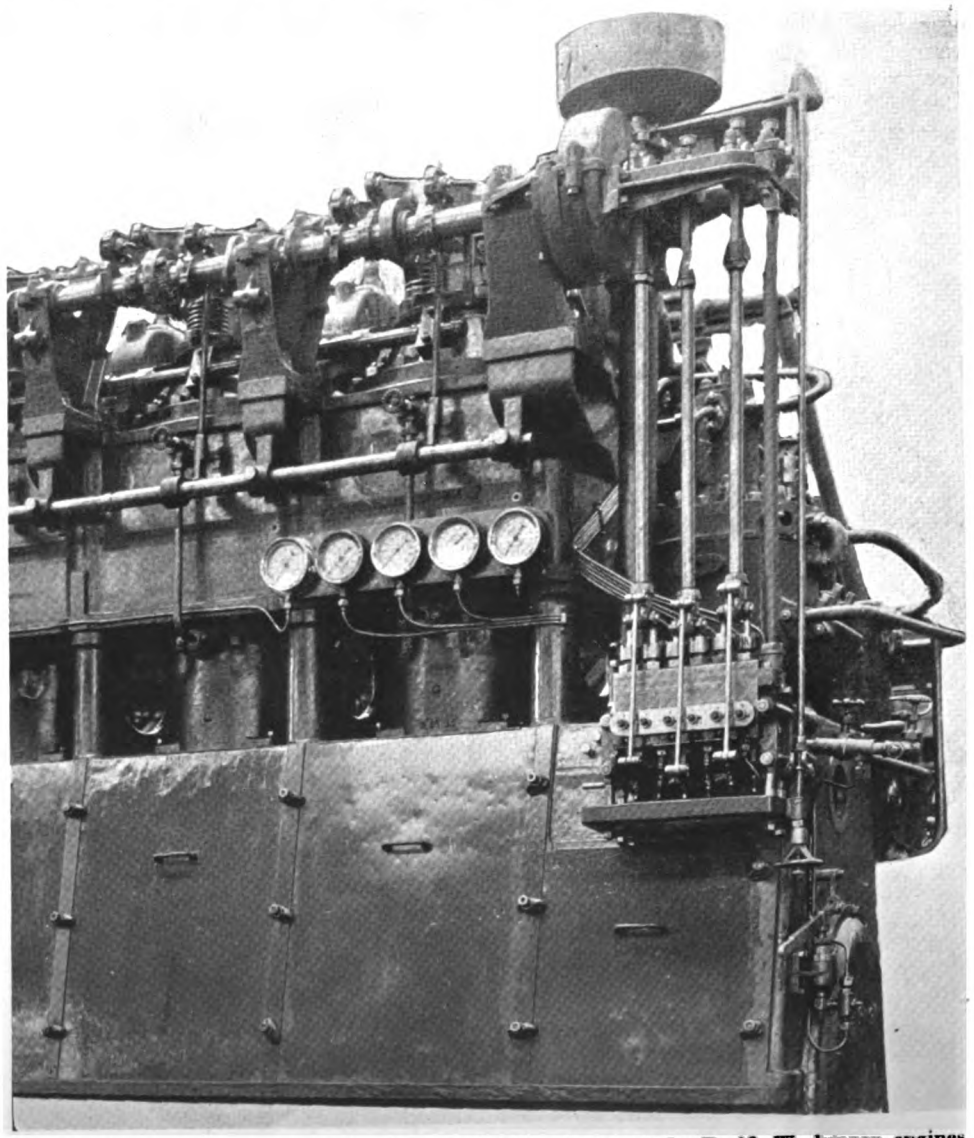
The "Golden Gate" was designed and built by James and R. J. Robertson. The two deciding factors which determined the kind of propulsion used were the gain in power made possible by independent motors and the well known economy possible with the use of Diesel engines. Besides reliability in power plant a hull of exceptional strength was necessary, because the ferry has to cross the Golden Gate against a heavy swell and wind from the Pacific plus a swift tide estimated at two knots.

Ordinarily the control of the vessel will be in the pilot house. Instead of the clanging of the engine-room telegraph familiar to all commuters who use steam ferryboats, the only sound that will indicate when the vessel is to stop or start is the clicking of the controller, which probably only will be heard inside the pilot house itself. In addition the steering will be done by electricity, an Allan & Cunningham steering gear having been installed.

Although there are three control stations, one in each pilot house and the third in the engine room, it is only possible to operate from one of them at a time, as the result of an arrangement on the control board in the engine-room. The Ward Leonard system of control is used, which does away with the necessity of opening switches on the control board, but permits any motor or generator to be cut out of the circuit immediately if something goes wrong. The controller is so designed that when going in either direction the after motor, which is doing all the propelling, turns over at approximately 180 r.p.m while the forward motor turns at slower speed, as stated.

The thrust from the propeller is absorbed by a Kingsbury thrust of 16,000 lbs. per square inch capacity. It is located in the main engine room, between the motor and propeller and directly connected to the motor coupling. The propellers are 8 feet in diameter, having three elliptical blades, 10′ 6″ pitch and 19.5 developed area. The shafting is 8⅝″ in diameter. The wheels have solid hubs and are machined to a true pitch and carefully polished. They were supplied by the Hyde Windlass Company.

There are two main fuel tanks, located amidships, one on each side of the vessel. They hold 45 barrels each. The day or watch tanks,



Showing fuel-pump, governor and valve-gear details of one of the Pacific-Werkspoor engines of the "Golden Gate."

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holding 6¼ barrels each, are placed above the main fuel tanks. They are filled every watch (eight hours). Each engine is supplied with fuel from its own tank independent of the other engine and main tank, although the pipe installation is so arranged that all the tanks are cross-connected in case an emergency should make pumping from one side of the boat to the other necessary.

Each engine has a Kinney fuel-transfer pump, while there is also a Kinney rotary pump for emergency service and for transferring fuel when the main engine is closed down. This is driven by a General Electric 1 h.p. marine type motor. From the day tanks there is gravity feed of the fuel through an electric heater to the fuel injection pumps.

For lubrication the "Golden Gate" has a Kinney rotary lubrication service, consisting of two pumps driven by each main engine, one pump supplying pressure to the force feed system, the other providing for the discharge from the crank case back to the lubricating oil tank. There is also an emergency pump driven by a 1 h.p. General Electric marine type motor, and a De Laval oil purifier driven by a Diehl electric motor.

The Rix air compressor is driven by a 15 h.p. 1150 r.p.m. compound-wound motor with automatic starting panel, of General Electric marine type. There is also a Rix Booster operated by a 5 h.p. 1700 r.p.m. General Electric marine motor.

A Sterling gasolene engine turning 900 r.p.m. supplies current for lights and is the basis of an emergency plant and also supplies power when the main engine is shut down. This engine, located above the deep water line, runs a 50 h.p. 25 k.w. 115 volt spare exciter generating set, the generator being General Electric marine type. There is also an auxiliary switchboard installed above the deep water line, serving as an emergency board. The lighting circuits are taken from it.

The motors operating the various auxiliaries are especially designed for marine service by the General Electric Company, being of the enclosed ventilated type, giving protection against drip or splash and are supplied with non-corrosive fittings so designed as to operate at a 15 to 20 degree angle of inclination without spilling the oil from the bearings.

The gasolene engine and the two Kinney 4-inch suction and 4-inch discharge fire pumps are located on the main deck in the engine room enclosure. These fire pumps, each driven by a 15 h.p. motor, are cross-connected to act as fire, bilge and auxiliary circulating pumps. There is also a bilge pump operated off each main engine.

Non-follow-up type steering engines are used, operated through a worm and gearing by a 7½ h.p. 115 volt direct current marine type motor turning 400 r. p. m.

To carry both engines, a 24-inch deep continuous floor was laid in the engine room. The floor is very flat, permitting the use of a continuous floor built especially to take care of the heavy weight—each engine weighing, with all equipment and spare parts, about 60 tons. The foundation consists of 18"x24" keelsons of a length sufficient properly to distribute the engine weight and the working load in a longitudinal direction.

Adding further strength is a steel engine-room truss, 120 feet long, running from one end of the boat to the other. This truss is of angle-bar construction, with chord 4x6 one-half inch bars. The strut angles are 4"x4" and the truss itself 12 feet deep. Under the truss is a 14x30 keelson to which the truss is fastened through with one-inch galvanized bars, nuts permitting tightening up. All the truss fastenings are galvanized.

The lines of the "Golden Gate" are somewhat different from other ferries, as the water line endings below the load line are of full form while her section is of a bulbous character, permitting the use of a short sleeve log and tail shaft, the shaft being 11 feet in length compared with the 24-foot shafts ordinarily found in such vessels. At and above the light load line her water lines are fine and prolonged.

A balanced type rudder made of ⅞-inch steel plate is used, being of an overhang type with the guide bearing at the lower end, the main weight taken at the upper end of the stock. Diameter of the rudder post is 5½ inches, with a 4 foot quadrant radius. The area of the rudder is 45 square feet.

The estimated consumption of fuel oil is 12½ barrels for each eight hour watch, and the estimated lubricating-oil consumption for the same period about two gallons. Diesel-fuel-oil of 24 degrees gravity was used in the "Golden Gate" on her first trips, but ordinarily it is planned to use standard boiler-fuel oil of 16 to 18 degrees gravity, which is 30 to 40 cents a barrel cheaper.

For each watch the personnel of the new ferry consists of a captain, a chief-engineer, a licensed engineer, an oiler, cabin watchman, two mates and four deckhands. The day is divided into three watches of eight hours each.

Speed made on the Fourth of July trips was about 12 knots. Steam ferries against which the "Golden Gate" will compete make about 11½ knots. The new boat made the distance, about 3.6 n. miles when the wind, current and tide permit traveling the shortest route across from San Francisco to Sausalito, in 18 minutes. Unfavorable wind and water conditions lengthen out the trip to about four n. miles.

Standard Oil Company Orders Diesel-Electric Driven Tanker

Vessel of 2,725 Tons Displacement to Be Propelled by Pacific-Werkspoor Diesel Engines in Conjunction With General Electric Drive

ON the Pacific Coast during the last few years, the Standard Oil Company of California has been doing considerable pioneer work in connection with the Diesel type oil-engine drive and electric auxiliaries for the propulsion and operation of oil-carrying tankers. The lead that this company has taken in their particular sphere has been watched with considerable pleasure by oil-engine building companies on the Pacific Coast as they realize how important it is for the big oil companies to show the way in the adoption of a prime mover that means economy in the consumption of fuel-oil; hence efficient operation of commercial vessels.

It is very unfortunate that only a very few of the leading oil companies on the Atlantic Coast have given the encouragement to this class of power that the Californian Standard Oil Company has done, especially as the oil-engine obviously is the solution of economical power in merchant craft, and its use in conjunction with electricity undoubtedly considerably broadens its scope, and eventually means the entire elimination of steam for every purpose aboard ship with the possible exception of heating the cargo-tanks in the case of a tanker transporting very heavy grade fuel-oil.

It will be remembered that the first motor-tanker of the Standard Oil Company of California was the "Charlie Watson," which was placed in commission at the end of 1920. She was followed by the "H. T. Harper" a little less than a year later. Both these vessels are directly propelled by twin Pacific-Werkspoor Diesel engines.

The successful operation of these two motorships has prompted this company to again take the lead in the Diesel field by contracting with the Union Plant of the Bethlehem Shipbuilding Corporation for the construction of a Diesel-electric propelled single-screw tanker for bay and coastwise service. This form of propulsion, which combines the economy of the Diesel engine with the flexibility and steady torque of the electric motor, has after careful and thorough comparison been selected for this vessel. The modern tanker, which has a large cargo-handling capacity in her cargo pumps, requires a correspondingly large auxiliary plant for supplying power to these motor-driven pumps. The economy of the motor-driven pumps, supplied with power from Diesel-electric generating-sets, as compared to reciprocating steam-pumps is most pronounced, the fuel consumption of the former being about one-tenth that of the latter. In Bay service, where the time consumed in discharging cargo constitutes from 30% to 50% of the total operating time, and when the sea trips are comparatively short, this becomes an important consideration.

In the Diesel-electric drive the necessity for an auxiliary plant is eliminated, as the same generating sets which supply power to the propelling motors while the vessel is under way, furnish power to the cargo pump motors while discharging the cargo.

In Bay service, where a great deal of maneuvering must be done, a direct Diesel drive always starts and reverses under load, so a considerable storage capacity of starting-air as well as ample auxiliary compressor capacity for replenishing same must be provided. While with the Diesel-electric drive this consideration is eliminated as the main engine does not stop as long as the vessel is in operation, and is always started without load. A very small amount of starting-air is thus required.

The ease with which this system of propulsion may be operated with a pilot-house control, whereby the vessel is brought directly under the control of the officer on the bridge, and the fact that if for any reason one of the two generating-sets must be cut-out of circuit, the vessel can proceed under three-quarters speed with the power of the remaining set, are other advantages of this type of propulsion.

Following are the principal dimensions and particulars of the new vessel:

Loaded displacement	2,725 tons
Deadweight	1,875 tons
Cargo-tank capacity	12,400 bbls.
Cargo-hold capacity	225 tons
Fuel-tank capacity	585 bbls.
Length	210' 0"
Beam moulded	40' 0"
Depth	16' 6"
Block coefficient	0.76
Mean loaded draft	15' 0"
Propelling motor power	600 B.H.P.
Estimated speed, loaded	9 knots
Fuel-consumption, running	24.5 bbls. per 24 hrs.
Cruising radius	24 days
Fuel-consumption, pumping out	15 gals. per hour
Pumping-out time	6 hours

The new tanker will be constructed on the transverse system of framing, and will have a single steel deck, with a short forecastle and a long poop, with a continuous expansion trunk in way of the cargo-tanks extending three feet

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above the deck. A continuous bulwark with ample freeing ports is fitted between the poop and forecastle for carrying a deck load without danger of having it washed overboard. The engine-room is aft and the pump-room immediately forward of same. A cargo-hold is fitted just abaft the collision bulkhead for carrying package freight. The space between this hold and the pump room is divided into four cargo tanks with a cofferdam at the forward end which may be used as reserve bunkers. Fuel tanks are fitted in the pump room wings, port and starboard. The after peak will be fitted to carry fresh water, and the forepeak for ballast. The space under the forecastle will be fitted for package goods which may be handled on trucks through the large watertight doors of the bulkhead. All hatches, cargo discharge and other piping, as well as other deck obstructions, are placed on top of the expansion trunk, leaving the balance of the deck clear for handling of package goods as well as cargo hose. To further facilitate such handling, the ordinary wire rigging has been eliminated, the mast consisting of an H steel column with channel bracings carried to the sides of the expansion trunk. For handling package freight, and to handle the cargo hose there are provided three 3-ton wooden booms and two single drum motor-driven winches operated by separate watertight controllers mounted at the cargo hatch coaming.

A motor-driven windlass, fitted with warping heads, is fitted on the forecastle deck, and a motor-driven steering engine with electric operation from pilot house will be fitted under the poop deck aft. The steering-engine is also equipped with hand gear. Quarters are arranged for the crew under the poop deck at the side of engine casing, port and starboard, with the mess rooms and galley amidship, just abaft the engine casing. A small refrigerating-chamber with an ice machine is also provided for. The captain's and a salesman's quarters are fitted on top of the poop deck, and a pilot-house, chart-room, and a navigating-bridge directly above,—thus all the quarters and control positions are centralized.

As a study of the preliminary plans will show simplicity in construction and convenience in operation have been the deciding factors in the working out of the various details of design.

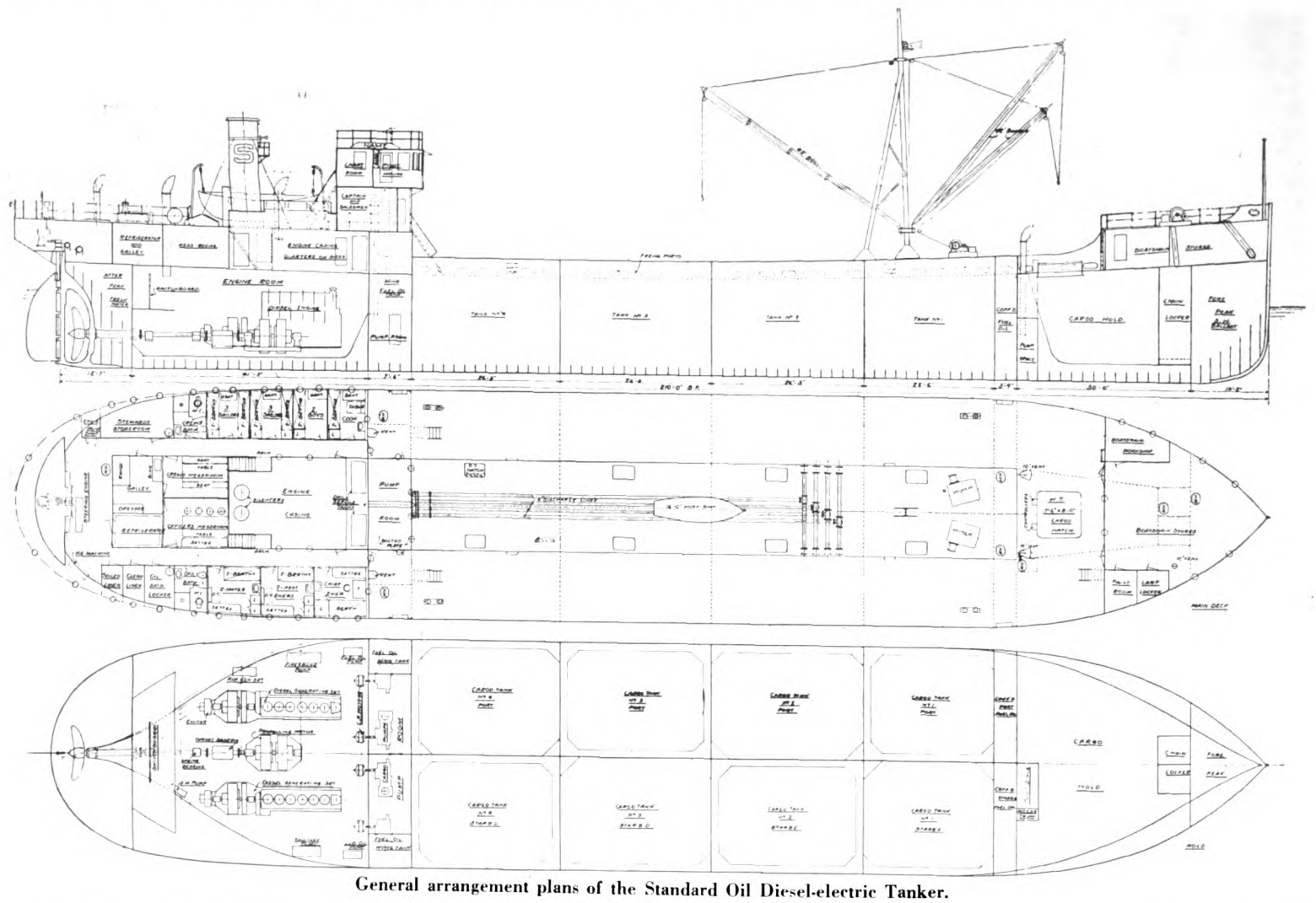
The propelling machinery, which is of particular interest, consists of two 400 B.H.P. six cylinder four-cycle trunk-type, non-reversible Pacific-Werkspoor Diesel engines, each direct connected to one General Electric 245 K.W. 230 Volt, 265 R.P.M. direct-current compound-wound generator, with a 30 K.W. 115 volt compound-wound overhung exciter mounted on the same shaft. The generator and engine bed-plates are bolted directly together, and fitted on a common seating. The propelling motor, which consists of two 300 H.P. 130 R.P.M. 230 volt shunt-wound motors mounted on the same shaft with a common base, are also being supplied by the General Electric Company. The two generators and motor armatures are connected in series, with one motor between each generator. Double-pole double-throw switches are provided for each unit, thus permitting either generator or motor to be cut out of circuit, and by throwing the switch in the opposite direction, the circuit is left intact. The exciters are made over-size, and are capable of supplying power for all the auxiliary machinery (except the cargo pumps) besides the excitation current for the generators and propelling motor. These exciters are arranged with double-throw switches connecting two sets of busses so that the load may be divided between the two machines to the best advantage. The main controlling equipment is arranged on the Ward Leonard system.

With this system of control the Diesel engines and generators run continuously at constant speed, while the speed and direction of rotation of the propelling-motor is altered at will by changing the generator voltage. This is accomplished by means of a controlling rheostat located in the engine-room but operated through remote control from the pilot house.

As the field windings of the generators are arranged differentially, any excess current in the main line, above that to which the machines are adjusted, will reduce the generator voltage, and thus automatically protect the system from excess strains, without risking the opening of the circuit by a circuit breaker at a critical moment, as when the officer is throwing the control lever from full ahead to full astern to avoid collision. With this protective arrangement it has been possible to eliminate all automatic circuit opening devices from the main circuit.

Each generator is provided with two field rheostats and a double-pole double-throw switch. One of these rheostats is used when the generators are supplying power to the propelling motors, under which condition no adjustment of voltage can be made, while the other rheostat is thrown into the field circuit when the generators are supplying power to the cargo-pumps, under which condition the field may be altered as desired. Under these conditions the series field of the generator is also thrown out of circuit, in order to prevent a fluctuation in voltage due to heavy starting currents. The field switches of the motors are interlocked with the main line switches in order to prevent opening of the field, thus short-circuiting of motor armature.

The exhaust from the main Diesel engines is carried through specially designed water-heaters, which are supplied with water by a separate heating service pump discharging di-



General arrangement plans of the Standard Oil Diesel-electric Tanker.

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rectly to the heater. This water is utilized for the heating of all quarters through regular steam radiators, and also for supplying hot water wherever needed. Heating coils in the daily service tanks are also connected up to the same system. To control the amount of hot water a by-pass around the heater is fitted whereby any or all gases may be passed directly into the exhaust silencers.

Each engine drives a set of attached pumps consisting of lubricating-oil, cooling-water, bilge, and fuel-oil daily service pump in addition to the regular fuel-injection pumps. With this arrangement a sanitary and heating service-pump is the only one required to run under ordinary operation.

In addition to this pump there is installed an independent fire and bilge pump and one fresh-water pump, two small emergency hand pumps, one to handle fuel-oil to the daily service tanks and the other for emptying the lubricating-oil drain tanks. As the amount of starting-air required is very small, no auxiliary air-compressor is fitted.

A storage battery and a small auxiliary generating-set is furnished for supplying light when the vessel is not in operation. The pumping equipment, which has a comparatively large capacity, consists of four motor-driven pumps. The pumps are located in the pump room and driven by a motor located in the engine-room, the shaft being taken through the bulkhead through a stuffing-box. With this arrangement the pumps are always under the observance of the engineer, and separated from the pump-room, where excessive gases may accumulate. Each pump has a separate suction and discharge line, all suction lines being connected one to each tank, and cross connections as well as sea suction and overboard discharge are arranged on suction and discharge sides of pump, thus four different grades of oil may be handled either loading or discharging at the same time without danger of mixing. The equipment is capable of discharging the vessels' entire cargo in about six hours.

Cuban Motor-Tug "Caibarien"

Third of the Munson Line's Fairbanks-Morse Engined Tugs to Be Described in "Motorship"—A Fourth Tug Now Building

ONE of the subsidiaries of the Munson Steamship Line is the Caibarien Transport Company, which operates the Fairbanks-Morse-engined tug "Caibarien." This tug is used in towing barges laden with sugar at Caibarien, Cuba, and since going into operation on May 20, 1920, has made a good record. She was built at Tarpon Springs, Fla., and the 200 h.p. Fairbanks-Morse oil-engine was installed at the Tampa Dock Company, Tampa, Fla., after which she immediately sailed under the Cuban flag.

This tug is heavily constructed of wood and has the following dimensions—

Length	85′
Breadth	18′6″
Draft	8′

Another tug is the "Munevitas," 85′ 5″ long, 18′ 5″ breadth and 8′ draft, which was illustrated and described on page 117 of the February, 1922, issue of MOTORSHIP and has a 200 h.p. Fairbanks, Morse engine. The Munson Line recently purchased the "John T. Hughes" which has a 100 h.p. Fairbanks Morse oil-engine and was described in the same issue on page 118. She is 70′ by 19′ 6″ by 6′ 0″. A fourth Fairbanks-Morse engined tug for this line is now completing in New York.

In an interesting letter received from Thorwald Hansen, engineer of this tug, MOTORSHIP has received valuable data on the operation of such tugs, and we believe that our readers would be interested in learning not only of the satisfactory and economical operation of this tug, but also of the few details which make for the success of such a craft.

One of the principal requirements of a tugboat is that the big slow-turning motor must have the very strongest of engine foundations, and in the case of the "Caibarien" it was found that vibration was somewhat too great. At the end of the operation of handling the first sugar crop the engine was taken out and a new engine-bed was built-in of two pieces of hard wood 18″ x 18″ x 20′ long, fastened on top of the ceiling.

However, the vibration was not reduced, and because the next 1921 sugar crop was to be handled very soon it was decided to wait until the completion of this work before going further. At this time the engine was again removed and the bottom of the boat, in the way of the engine, practically made solid wood and in addition four keelscons 16″ by 18″ running from the bow to the stern were notched down over the frames of the boat. On top of these pieces channel irons 40′ long were fastened and the engine bolted on top of these. There was then practically no vibration, and the general operation of the engine has been greatly improved by reason of this exceptionally solid foundation.

At Caibarien the steam-tug "Marie" of 150 h.p. is operated by the same owners and it is interesting to note that the oil-engined tug "Caibarien" has only two men in the engine-room and operates at one-half the fuel cost of the steam tug "Marie." The "Caibarien" is ready to leave the dock at a few minutes notice, while the "Marie" requires considerable time to get-up steam. Also, in view of the fact that the water is very shallow a large supply of fuel cannot be carried and in the case of the steam-tug it is necessary to run back into Caibarien for coal and water, while the fuel-capacity of the "Caibarien" is 4,600 gallons, which gives her a radius of about 5,500 miles when running light without tow. Under the stern is a ballast tank which can also be filled with about 2,000 gallons of fuel-oil, giving another 2,400 miles radius. As the work lies mostly in shallow water within a radius of about 50 miles, the tremendous advantage of the oil-engined tug is at once evident.

The task of towing these great square-end barges is not an easy one, because in the shoal waters the barges create a considerable amount of suction. Often, as many as six 430 ton barkes are handled through a narrow channel opening into Buena Vista Bay.

The hot climate has its effect on the use of lubricating-oil, so it is considered best not to economize too strictly on this important item; the minimum which is considered safe is ½ gallon per hour. Engineer Hansen states that his engine has never had a burned-out bearing, but has had four connecting rod bearings and one main bearing replaced in the two years of operation, which is considered not unsatisfactory, in view of this hard service in a hot climate where severe work is put on the babbitt of the bearings. A large supply of lubricating-oil is carried, which is forced to a daily-tank by air-pressure and then runs by gravity to the lubricators on the engine.

Operated at about 220 r.p.m. when towing, the "Caibarien" normally consumes 10 gallons of 36 degree Baumé fuel-oil, and while running light, the consumption is 8 gallons per hour. About every two months the muffler is cleaned-out.

In addition to the 200 h.p. Fairbanks-Morse oil engine installed in the "Caibarien," there is a 6 h.p. Fairbanks-Morse kerosene-engine driving an auxiliary air-compressor and fire-pump, while a centrifugal-pump driven by belt off the intermediate-shaft pumps out the bilge and ballast-tank A 1½ K.W. generator is mounted over the fly-wheel driven by belt from same, and a 3 h.p. Hercules gasolene-engine is also lined-up with the generator so that electricity can be generated when the main-engine is not in operation. Operated by air, a Worthington steam-pump is used to pump fuel from the main fuel-tanks to the daily-service tank—this leaving the fuel-pump on the main engine available for pumping the bilge. The water for galley and lavatories is under an air-pressure of ten pounds.

The "Caibarien" is now completing the work of handling transportation of the third crop of sugar and has towed at least five times as many bags of sugar since she has been in commission as the steam tug "Marie" has handled, and she has always been ready to go out at a moment's notice, with the exception of three days last year. With two 150 ton barges light she has made a tow from Tampa to Caibarien, Cuba, in 114 hours running time. From January 6th to May 20th this year the "Caibarien" has operated 1,376 hours, in which time only one stop of 15 minutes was made to remove an obstruction in the cooling water pipe. Undoubtedly the work of the "Caibarien" is adding another page to the successful record being made by oil-engined tugs.

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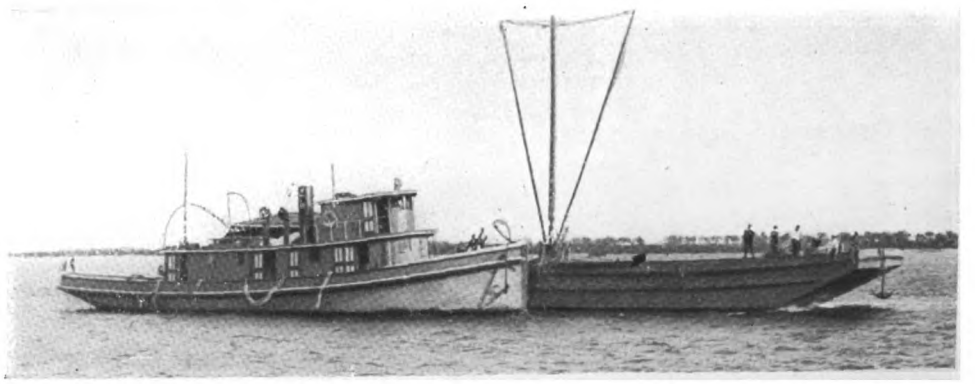

The Motor-tug "Caibarien" with Sugar Barge Alongside

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COST OF OPERATING A FLEET OF MOTORSHIPS

BEFORE us as we write is a copy of the report for the last year's operation of the East Asiatic Co., Ltd., the end of the financial year being March 27th last, which concluded 25 years of operation of this great trading company. An idea of the cost of operating this fleet of motorships is possible from their published figures. We note that the total gross profit for 1921 is a little over 26,000,000 kr. of which 6,600,848.44 kr. were profits derived from the operation of their cargo vessels. This fleet at the expiration of 1921 consisted of 22 large craft, namely 18 motorships, one steamship, two motor-auxiliaries and one sailing-ship, aggregating 165,000 tons deadweight in addition to a considerable amount of lighterage craft, tugs, etc. The company has adhered to the policy of keeping its fleet on the level with development by disposing of old steamships and acquiring new motorships. The result of this procedure is that at the expiration of 1921 the average age of their ships was 4½ years with a book value of 225.34 kr. per d.w. ton, or about $48.55 at the current rate of exchange of 21.50 cents per kroner.

The report states that the company will employ Diesel motorships exclusively for its regular routes, because the expectations of the economy and working of this type of vessel have been fully realized. Until prospects can be more easily gauged the company is leaving the completion of its large constructional program (consisting of 18 unbuilt motorships) in abeyance. As the company together with its affiliated concerns has altogether built 122 steam, motor and sailing-ships of nearly 600,000 tons d.w. it is in good position to compare the values of steamers and motorships on the same routes. During the last quinquennial period the average price on their motorships has been 730.16 kr. per ton, which has been due widely to war conditions, so this has wisely been written down to 459.14 kr. per ton. During the last 25 years the company lost seven steam and motorships. This includes the ms. "Malakka" which stranded in a fog in 1914, the ms. "Anholt" which stranded through a hurricane the same year, the ms. "Maracaibo," sunk by gunfire in the North Sea and the ms. "Columbia," torpedoed in the Mediterranean in 1918.

It is interesting to note that for this fleet of ships the company paid 3,193,708.02 kr. for oil and coal, 3,527,547.32 kr. for wages and provisions, of which stocks on hand amount to 551,646.40 kr. The total book value of the vessels is 37,174,885.21 kr. not including the lighters and tugs. The aggregate cost of operating their ships including fuel, wages, provisions, canal dues, Consular fees, pilotage and towing, loading and discharging, classification, repairs, stores, maintenance, agents' commissions, insurance, transhipment, conference rebates, claims, cables, advertising and sundries was 19,618,712 kr. or equivalent to about $4,218,023.08 at the current rate of exchange of 21.50 cents to the kroner. It will be interesting to compare these operating costs with those of similar steamship fleets both European and American. It is obvious that there must be a tremendous saving on the fuel bill, due to the economical consumption of the Diesel engines. The company's fleet is as follows:

Name of ship.	Year built.	Tons Gross Reg.	Tons D.W.	I.H.P.
M/S "SELANDIA"	1912	4,950	7,450	2,500
M/S "JUTLANDIA"	1912	4,874	7,600	2,500
M/S "SIAM"	1913	6,636	9,940	3,300
M/S "ANNAM"	1913	6,635	9,940	3,300
M/S "FIONIA"	1914	5,218	6,820	4,100
M/S "TONGKING"	1914	6,645	9,812	3,300
M/S "FALSTRIA"	1915	4,358	7,000	2,500
M/S "PANAMA"	1915	6,650	9,812	3,300
M/S "AUSTRALIEN"	1915	6,650	9,812	3,300
M/S "CHILE"	1915	6,913	10,400	3,300
M/S "PERU"	1916	6,919	10,400	3,300
M/S "MARTINIQUE"	1916	525	843	320
M/S "ASIA"	1919	7,014	10,800	3,300
S/S "BANKA"	1919	1,684	2,350	710
M/S "DANA"*	1919	364	550	200
M/S "AFRIKA"	1920	8,597	13,275	4,500
M/S "MEXICO"	1920	3,013	4,500	1,600
M/S "MALAYA"	1921	8,654	13,400	4,500
M/S "JAVA"	1921	8,681	13,160	4,500
M/S "VIRGINIA"	1921	641	980	500
M/S "KOBENHAVN"*	1921	3,965	5,125	650
S/V "THOON KRAMOM"	1921	781	1,000	....
		110,367	164,969	

*Auxiliary sailing ship.

Some of the ships have been altered from shelter, to awning decked, the carrying capacity being thereby increased.

TUGS, LIGHTERS, ETC., AS AT DECEMBER 31ST, 1921.

	Tons Gross Reg.	Tons D.W.
Copenhagen:		
8 Lighters	1,670	2,921
Bangkok:		
27 Sea-going and River Lighters	2,502	3,728
10 Tugs and Steam Launches	361	....
	4,533	6,649

MOTORSHIP PROGRESS AND TECHNICAL ADVICE

OCCASIONALLY we hear of some firm contemplating building and operating Diesel-vessels of special types for certain work, but ultimately the actual construction is postponed. It is often the great amount of projected work which does not materialize which creates the feeling in some quarters that there is not much actual Diesel-vessel construction. These delayed constructions are inevitable in any line of shipping, particularly during varying trade conditions; but because the project happens to have a Diesel-engine included some seem to consider it fair game for belittling Diesel-engine progress.

The real cause of the delay is rarely due to excessive cost of the Diesel-installation—although this cost is higher than that of steam—but is due to financial conditions in general and the delay over the Subsidy Act and lack of a definite Federal shipping policy rendering it impossible for many concerns to strike out at the pace which they have the foresight to realize is the one they should set. While the present conditions are intolerable we can safely be optimistic regarding the near future for the motor-ship rather than too critical of the present progress in actual contracts now under way, remembering that where there is so much smoke there must be fire and that numerous inquiries for motorships and Diesel-engines from shipping concerns are the surest sign that America is rubbing the sleep from her eyes and that Diesel-driven ships are to be ordered. In fact the number of new motorships, steamship-conversions and motor work boats under way to-day is really better and more encouraging than we could anticipate under existing business conditions, and immediate prospects are good.

Unfortunately it has required a long period for American shipping men to actually decide upon Diesel-engines for their new constructions, we do feel that many of these men—regardless of prejudiced and misleading technical advice, are now so awakened to the possibilities of this engine that they will demand on the part of their naval-architect and consulting engineer as well as from their engineering staff a thorough knowledge of the Diesel-engine and a readiness to specify and install this most reliable and economical marine power-plant.

Is it not reasonable to assume that an American shipowner and operator who reads of the net savings his foreign competitors are making with motorships should demand that these technical advisers upon whose advice he entrusts the expenditure of his money be thoroughly informed and of an open mind? Or is it not still reasonable to assume that such an operator, having become acquainted with the advantages of motorships should himself decide to invest the slightly higher initial outlay in a modern advanced type of power-plant which will save operating expense and bring profit rather than allow his money to be put into ships equipped with a prime mover that has become economically obsolete. Every American shipowner should ask himself "Where do I stand in regard to the Diesel-engine and the motorship, and what is the attitude of my technical advisers?

STEAM ENGINES AT 70 CENTS PER HORSEPOWER

DURING last June 202 unassembled triple-expansion marine steam-engines of 1,400 i.h.p. each were sold by the U. S. Shipping Board at public auction for $222,860, or at an average of $1,103 per set. This is about 70 cents per h.p. This, of course, is a compliment to the higher commercial value of oil-engines, because the 17 Diesel units which have already been sold by the Board have produced quite a high salvage value. Consequently, the Government should be gratified with the results. It is the opinion of one Diesel-engine manufacturer that the flooding of the market with this steam machinery at less than scrap-metal prices will not tend to interfere with the business of oil-engine builders, as there is hardly any chance of any of the above 1,400 h.p. steam-engines ever going out and making a record for themselves, for some of them were built by every Tom, Dick and Harry and could not be depended upon if they were put in a ship, but that those which have been purchased will be salvaged for the material in them. The amusing side of this affair,—at least it would be amusing if it were not serious. is that a number of these steam-engines were constructed by Diesel-engine builders whose facilities were especially adapted for the construction of oil-engines, whereas the Board insisted upon their building steam engines, which action we strongly opposed at the time.

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American Motorship "Missourian" Delivered

Second Cramp-B. & W. Diesel-Powered Vessel of American Hawaiian Steamship Line

DURING the early part of July the new 11,200 tons deadweight motorship "Missourian" was delivered by her builders, the Wm. Cramp Ship & Engine Company and, like her sister ship the "Californian," will be operated by the United American lines. As we write she has just arrived at New York and is being dry-docked at the W. & A. Fletcher shipyard to have her bottom painted. She will immediately proceed to Boston where she will load for the Pacific Coast and the Far East.

As she is taking the place of one of the Company's steamers now laid-up for repairs, the completion of this vessel was rushed, so the starboard engine was only run for twelve hours and the port engine for five hours at the Builders' dock prior to the trial trip.

On July 6th the six hours builders' trial was run down the Delaware River and back, the draft of the ship being 8′ 1″ forward and 12′ 9″ aft, no cargo being aboard. Owing to the vessel only being in deep water for a short while, the speed was affected.

Proceeding down channel the engines averaged 115 r.p.m. but when the ship reached deep water the starboard engine ran up to 121.7 r.p.m. and the port engine turned up at 118.9 r.p.m. The mean engine-speed for six hours was 116.65 r.p.m. for the starboard engine and 114.45 for the port engine, or 115.55 mean revolutions. At this power the two engines together developed 4,467 i.h.p.

The "Missourian" left Cramp's Shipyard at 12:31 P.M. on July 10th for the run around to New York, arriving at the Ambrose Channel at 6:39 A. M. and docking at the Fletcher Yard, Hudson River, at 8:20 P.M. The speed averaged from deep water to deep water was 12.45 knots. En route a three hours' run at high power was made, the starboard engine developing 2,536 i.h.p. at 121.15 r.p.m. and with the port engine developing 2,421 i.h.p. at 118.6 r.p.m. Thus a total of 4.957 i. h. p. was developed for the three hours at a mean revolution-speed of 119.65 per minute. This gave the ship an average speed of 13.75 knots. The total fuel used from dock to dock was 89 bbls. of 25.5 Baumé Port Arthur light fuel-oil supplied by the Texas Company. This oil worked-out at 7½ pounds to the gallon. The two main engines together consumed a total of 1,497 pounds per hour, which works out at 0.302 pound per i.h.p. hour.

One of the auxiliary Diesel-electrical generating-sets that was being run on the trip averaged about 90 b.h.p. or approximately 120 i.h.p. and used 47 pounds of oil per hour. Thus the total consumption for all purposes including the power of the auxiliary engine was 0.303 pound per i.h.p. hour.

Here it is interesting to note that the builders when figuring out the fuel consumption for all purposes did not include the power generated by the auxiliary engine, but included its consumption. Consequently, they get a consumption of 0.315 pound per i.h.p. hour, which to our mind is unfair to themselves, because the power of the auxiliary engine should be included thus bringing down the consumption per i.h.p. hour to 0.302 pound. The method they use in calculating power and consumption is one which they have been accustomed to when running steamer trials.

The "Missourian" differs from the "Californian" inasmuch that all the deck machinery is General-Electric equipped, whereas the "Californian" has Westinghouse equipment. On the "Californian" there are 14 Maine electric winches with G. E. C. motors and two Shepard electric-winches. Also there is an American Engineering Company's windlass with General Electric motors. A complete description of the "Californian" appears in the June issue of MOTORSHIP and the "Missourian" has similar dimensions.

SUCCESSFUL OPERATION OF THE WOODEN AUXILIARY "LA MERCED"

MOTORSHIP has recently mentioned several successful wooden vessels which owe their present operations to the fact that they have Diesel-engines in their engine-room instead of steam-engines. The general public have a well-established opinion that wooden ships must be failures.

Although not a full-powered motorship, the wooden auxiliary *La Merced,* owned by Walter Scannell, has performed creditably since going into service in December, 1919, after being completed by T. Robertson of Benecia, Cal. This typical West Coast auxiliary schooner is 232 ft. long, 43 ft. 6 in. breadth, 24 ft. 6 in. deep of 1,696 gross tons. The deadweight-capacity is 2,700 tons and two 160 h.p. Bolinder surface-ignition oil-engines furnish power as auxiliary to the sails. The speed is seven knots and the daily fuel-consumption is eight barrels of 24 degrees Baumé Calol supplied by the Standard Oil Co. of California; her fuel-capacity of 970 barrels is thus sufficient for a long cruising-radius. Her capacity is 1,200,000 cubic feet and the principal cargo carried is coal, lumber and case oil.

In December, 1919, the *La Merced* made her maiden voyage from San Francisco to Newcastle, New South Wales, returning via Callao, Peru, and in October, 1920, she again left on a similar voyage, on this second voyage visiting New Zealand as well. From this voyage she returned to San Francisco in July, 1921, and then made several coastwise voyages. In March of this year she left Gray's Harbor, Washington, on her third trans-Pacific voyage, touching at Honolulu en route to the South Sea Islands.

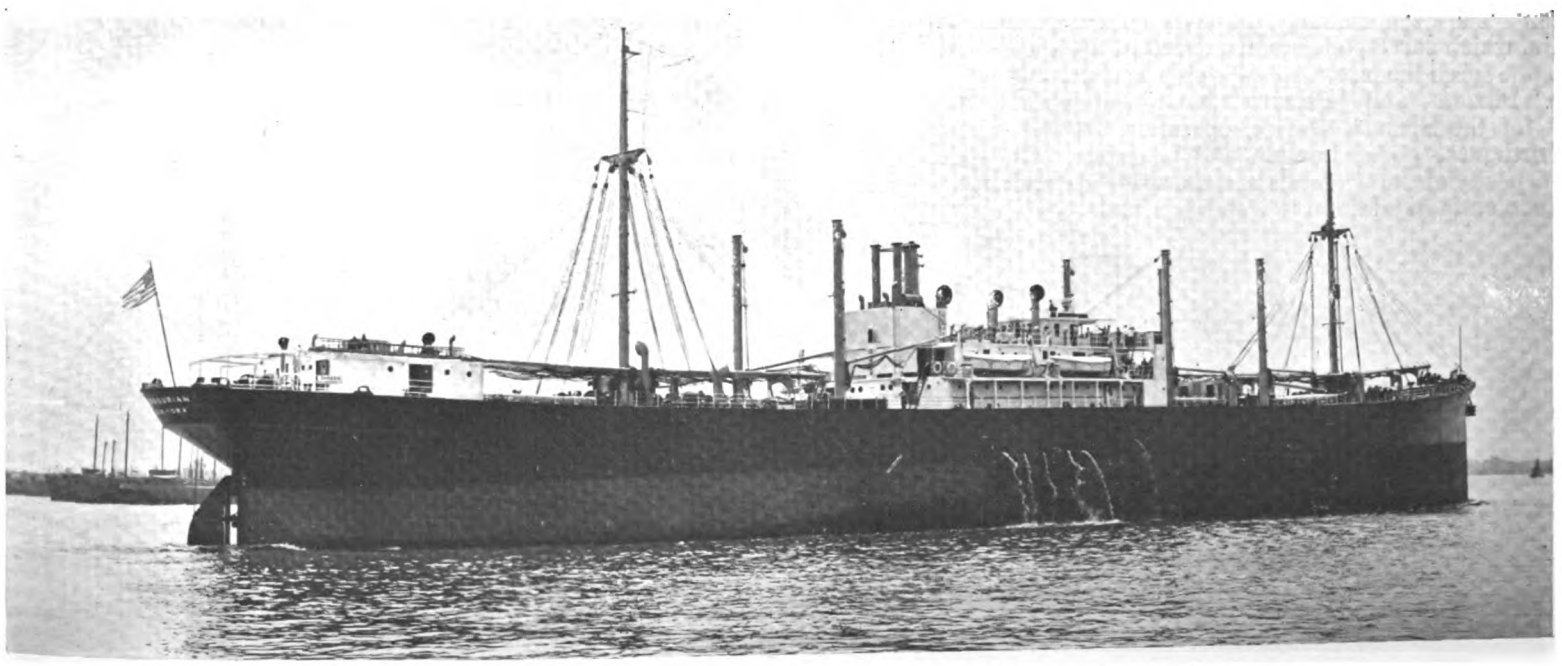
Up to the commencement of this third voyage this vessel had covered about 50,000 miles on a total repair cost of between $150 and $200 since December, 1919. Since the first voyage the only expense for parts has been $25, incurred this last Spring. Three men only, a chief engineer and two assistant engineers, form the engine-room crew, whose attention to the machinery is witnessed by their good performance. The daily operating cost of the entire ship is less than $100.

MUNSON LINE CONVERTING TWO STEAMERS TO DIESEL POWER

One of the American shipping companies which regards the motorship very favorably is the Munson Steamship Line of New York, headed by Frank C. Munson, whose outspoken advocacy of the Diesel-driven ship has often been quoted in the pages of MOTORSHIP. It is gratifying to note that this company has decided to at once adopt motorships and has purchased from the United States Shipping Board two single-screw sets of McIntosh & Seymour Diesel-engines, each engine being of 900 shaft h.p.

Mr. Alfred J. C. Robertson, naval-architect of the company, has prepared plans and specifications for the conversion of two Lake-built freight steamers of about 4,200 tons deadweight, which the firm has just purchased from the Shipping Board and in which these McIntosh & Seymour Diesel-engines will be installed. Shipbuilding yards will shortly be asked to bid on this work. These vessels are 253 ft. long, 43 ft. 6 in. breadth and 27 ft. 6 in. depth.

"Lule," the third standard 8,200 tons Diesel-driven ore-carrier for the Grangesbergsbolaget of Stockholm, was launched on June 17th at the Götaverken, Göteborg. Twin Götaverken B. & W. 1,400 i.h.p. Diesel engines are being installed.



The new t.s. motorship "Missourian," built by the Merchants Shipyard & Diesel-engined by Cramps.

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"Pinzon," one of two single-screw fruit-carrying motorships propelled by Beardmore-Tosi 1,290, i.h.p. four-cycle Diesel engines and owned by McAndrews Ltd., London. The sister motorship is named "Pizzaro"

Two Single-Screw Fruit-Carrying Motorships

BECAUSE the United Fruit Co. of Boston, Mass., have just ordered three Diesel-electric fruit-carrying motorships of 4,000 tons d.w. each from Cammell Laird & Co., Birkenhead, England, and because E. L. Goodsell of the Fruit Auction Co. is planning an 8,700 tons d.w. fruit-carrying motorship, the illustration on this page of the new British fruit-carrying motorships "Pinzon" and "Pizzaro," Diesel-engined by Wm. Beardmore & Co., Dalmuir, for McAndrews of London, should be particularly noteworthy to all shipowners in this country interested in the transportation of fruit. Two other fruit-carrying motorships are described on pages 607 to 612.

These vessels were built by Richardsons-Westgarth of Middlesbrough, England. The Beardmore-Tosi main engine is of the six-cylinder, four-cycle type 28.34" bore by 38.38" stroke with a rating of 1,250 shaft h.p. at 125 r.p.m. When in service the fuel-consumption at 9, 10 and 11 knots fully loaded was 3, 4 and 5.1 tons per day respectively, with the main engine turning at 95, 105 and 115 r.p.m. respectively.

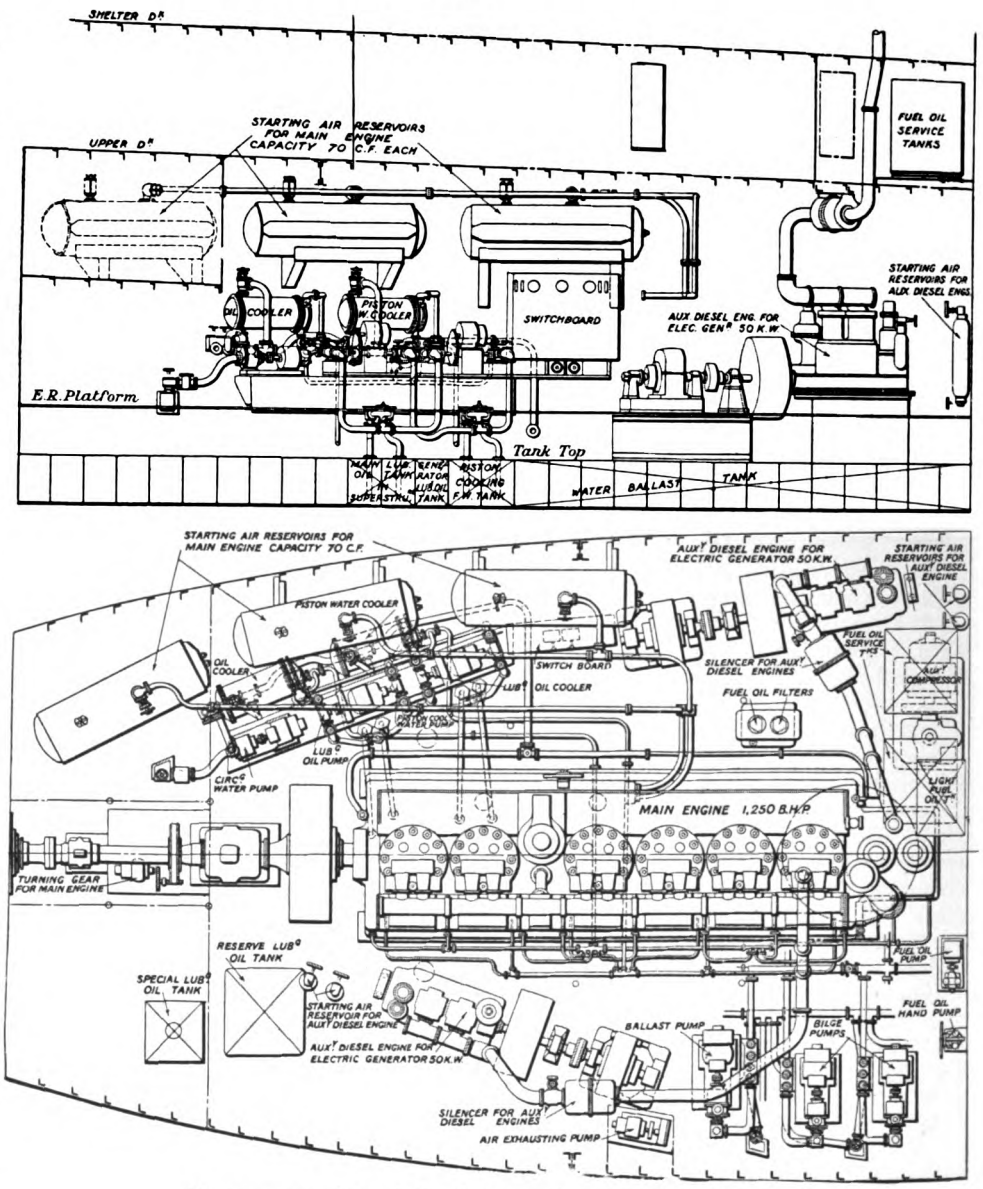
Following is an interesting comparison of the operating figures of the "Pinzon" and also of a steamship a little larger.

Motorship "Pinzon."
Diesel-engines, single-screw.
Ship, 240 ft. 0 in. × 38 ft. 0 in. × 18 ft. 0 in.; draught, 17 ft. 6 in.
Voyage, Glasgow to Spanish ports.
Diesel indicated horse-power, 1,290.
Equivalent steam indicated horse-power, 1,170.
Revs. per minute, 106.
Speed of vessel, 10.2 knots.
Oil used per day, *for all purposes*, 4.5 tons.
Oil used by auxiliaries per day, 0.2 ton.
Oil used in port per day, discharging and loading, 0.37 ton.

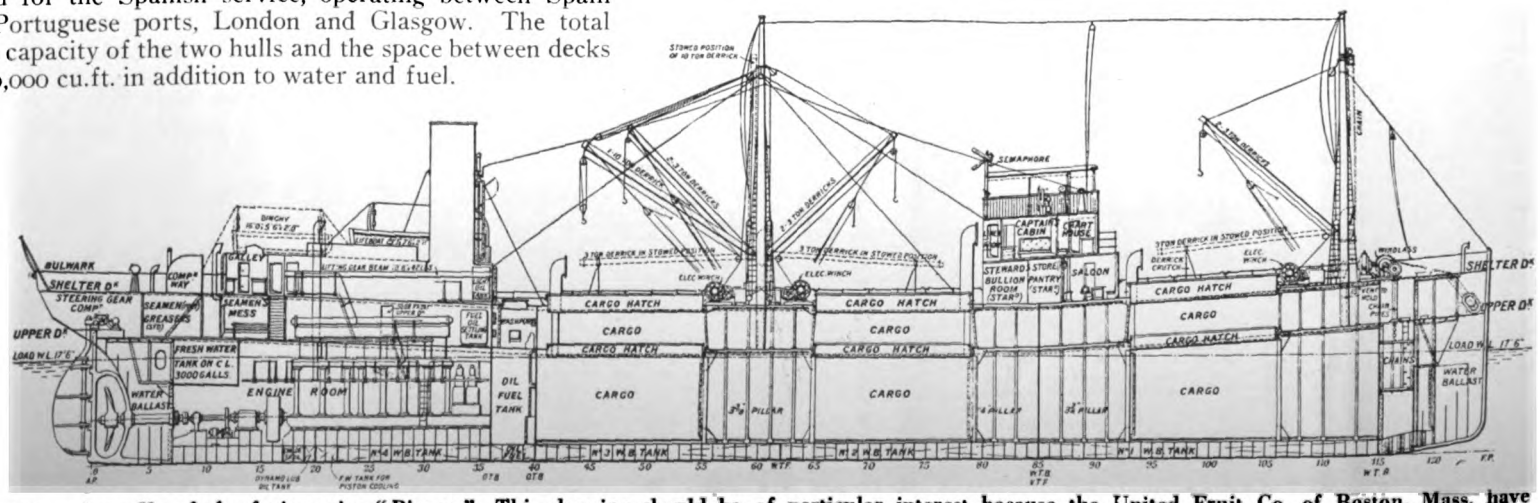
Steamship.
Triple-expansion engines, single-screw.
Ship, 270 ft. 0 in. × 38 ft. 0 in. × 18 ft. 0 in.; draught, 17 ft. 5 in.
Voyage, London to Spanish port.
Indicated horse-power, 1,073.
Revs. per minute, 75.8.
Speed of vessel, 9.35 knots.
Coal used per day, *for all purposes*, 17.42 tons.
Coal used by auxiliaries per day, 2.5 tons.
Coal used in port per day, discharging and loading, 3 tons.
Banked-fires, used per day, 15 days on average voyage, 1 ton.

It is interesting to note that the Diesel engine of the "Pinzon" has been running for considerable periods at 24 r.p.m. which corresponds with a speed of 2.5 knots. At this engine speed the piston-speed is only 150′ per minute.

The "Pinzon" and "Pizzaro" have been specially designed for the Spanish service, operating between Spain and Portuguese ports, London and Glasgow. The total cargo capacity of the two hulls and the space between decks is 110,000 cu.ft. in addition to water and fuel.


SHELTER D.K
UPPER D.K
STARTING AIR RESERVOIRS FOR MAIN ENGINE CAPACITY 70 C.F. EACH
FUEL OIL SERVICE TANKS
STARTING AIR RESERVOIRS FOR AUX. DIESEL ENGS.
PISTON W. COOLER
SWITCHBOARD
AUX DIESEL ENG. FOR ELEC. GEN.R 50 K.W.
E.R. Platform
Tank Top
WATER BALLAST TANK
STARTING AIR RESERVOIRS FOR MAIN ENGINE CAPACITY 70 C.F.
AUX.Y DIESEL ENGINE FOR ELECTRIC GENERATOR 50 K.W.
STARTING AIR RESERVOIRS FOR AUX.Y DIESEL ENGINE
PISTON WATER COOLER
SWITCH BOARD
SILENCER FOR AUX.Y DIESEL ENGINES
FUEL OIL FILTERS
LUB.G OIL COOLER
LUB.G OIL PUMP
CIRC.G WATER PUMP
MAIN ENGINE 1,250 B.H.P
TURNING GEAR FOR MAIN ENGINE
RESERVE LUB.G OIL TANK
SPECIAL LUB.G OIL TANK
STARTING AIR RESERVOIR FOR AUX.Y DIESEL ENGINE
AUX.Y DIESEL ENGINE FOR ELECTRIC GENERATOR 50 K.W.
BALLAST PUMP
BILGE PUMPS
FUEL OIL HAND PUMP
SILENCER FOR AUX.Y DIESEL ENGINES
AIR EXHAUSTING PUMP

Engine-room plan of the fruit-carrying motorship "Pinzon"



Inboard profile of the fruit-carrier "Pinzon." This drawing should be of particular interest because the United Fruit Co. of Boston, Mass. have ordered three two cycle Diesel-electric fruit carriers from Cammell Laird & Co. of England

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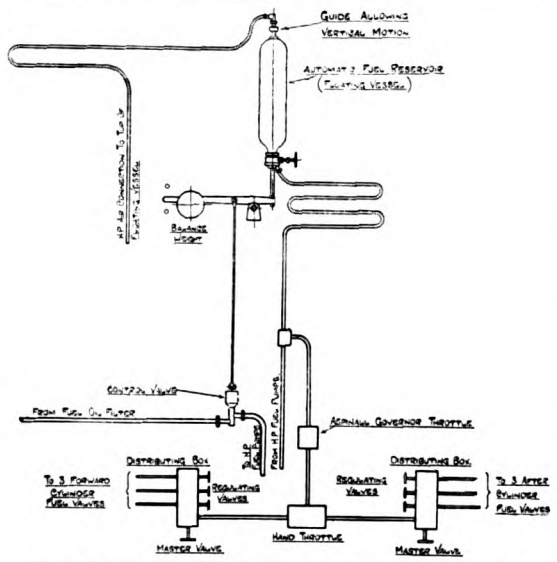
British Construction of Werkspoor Diesel Engines

DUTCH, French and American constructions of the well-known Werkspoor Diesel marine-engine have all been described and discussed in the pages of this magazine, including two American modifications of this design, so it is not without more than ordinary interest we deal with this motor as built under license in Great Britain for two single-screw and one twin-screw motorships by the North Eastern Marine Engineering Company, Limited, of Wallsend-on-Tyne, England. It is hardly necessary to mention that the original designers and licensors of the Werkspoor engine are the Nederlandsche Fabriek van Werktuigen en Spoorweg Materieel, Amsterdam, Holland, better known as the Werkspoor Works, who have adopted the policy of granting a number of manufacturing licenses in all leading shipbuilding countries—including three in the United States—instead of issuing exclusive rights.

With such an arrangement, however, there is a natural tendency for the individual licensees in each country to depart somewhat from the mother design partly to secure individuality, as has occurred in our own country. But happily no modifications have been made, we believe, that have not been in accordance with the licensor's ideas as best conforming with American shipboard practice and manufacturing. On the other hand in England the parent design has been much more closely followed—at least by the North Eastern concern, as we have not yet seen the Werkspoor engine as built by the other British licensee, *i.e.*, Hawthorne, Leslie & Co. Nevertheless in keeping with the progressive policy of the North Eastern Company some modifications have been made. Inter alia improved methods of examining the valves, increased facilities for piston inspection, and means for the regulation of the fuel and injection air when running at reduced speed were particularly noteworthy. We are enabled to illustrate the North Eastern-Werkspoor Diesel engine of the fruit-carrying motorship "Segovia" with an exceptionally clear photograph as well as drawings, enabling easy view of all its various features of design. Rarely do we receive such a fine engine picture. At this phase of the article we will interject a reference to a decision reported as formed at the Werkspoor Works to revert

North Eastern-Built Motors of the Fruit-Carrying Single-Screw Vessels "Segovia" and "Sevilla"



Fuel Supply and distribution of the motorship "Segovia"

from the steel-column construction to the more generally adopted cast-iron columns, such is being used in the New York-Werkspoor engine, and as Werkspoor themselves sometime ago adopted for their big stationary Diesel-engines. We understand that this is mainly being done to meet the preference expressed by shipowners for the cast-iron column design. But there cannot be any question of the combination steel and cast-iron construction followed up to now being other than practical and successful, and this design is clearly illustrated on the next two pages. The Pacific-Werkspoor Diesel is of the combination type but differs slightly.

The "Segovia" and her sister motorship "Sevilla," are two single-screw fruit-carriers built by Wood, Skinner & Co. of Bill Quay-on-Tyne, to the order of the Otto Thoresen Line of Kristiania, Norway. The ship for which the twin-screw of engines referred to have been built is a tanker of 10,350 tons deadweight for Hunting & Sons of Newcastle-on-Type now completing at the yard of the Tyne Iron Shipbuilding Co. of the same city. Each of the latter engines has an output of 900 shaft h.p. at 120 r.p.m. At this time particular interest is attached to these vessels because a big American fruit-ship company, namely, the United Fruit Co., has just ordered three Diesel-electric driven motorships from the British shipbuilding firm of Cammell Laird & Co., Birkenhead.

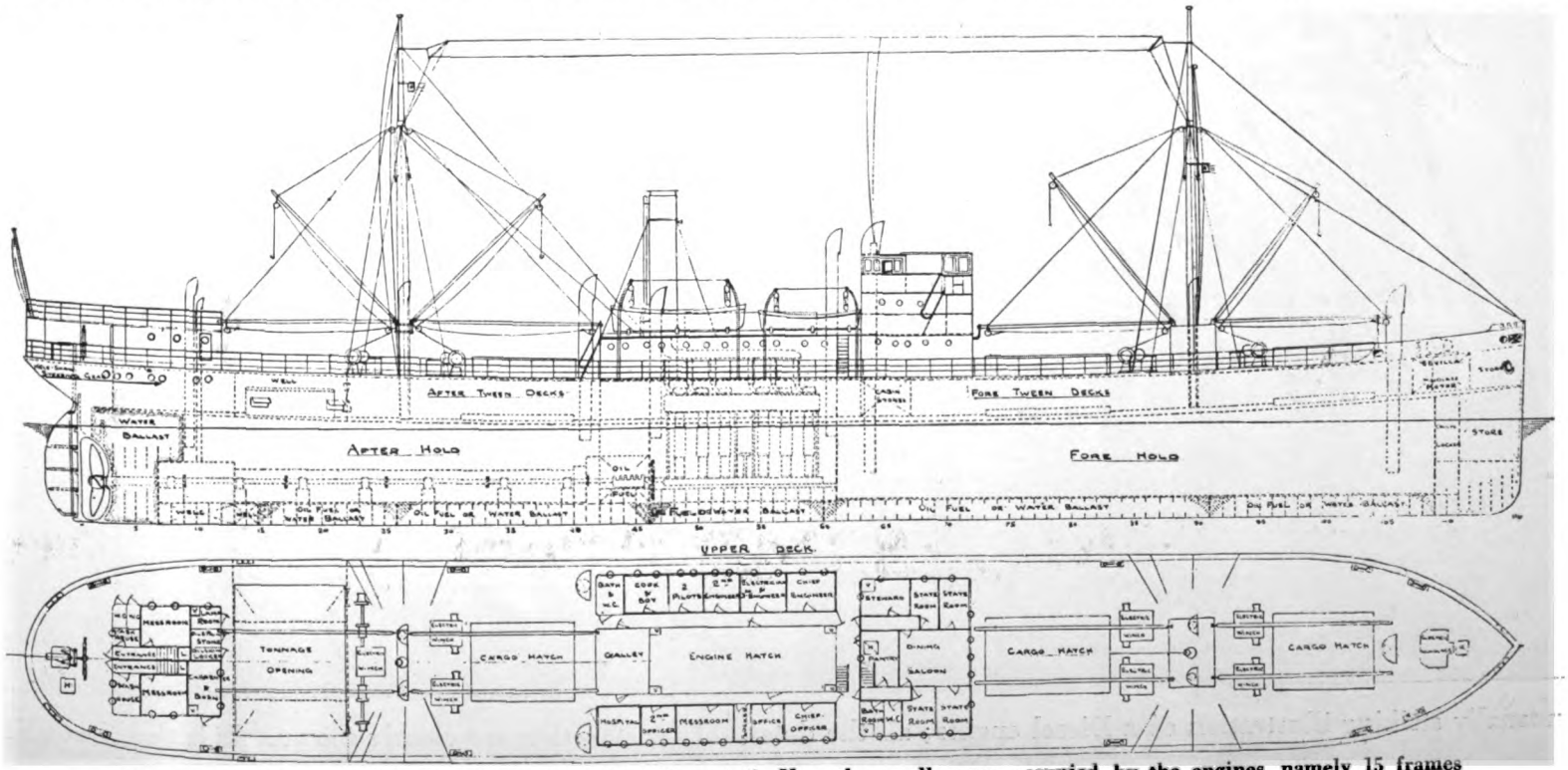
The engines of the two "fruiters" are of the six-cylinder four-cycle type, 22.047" bore by 39.370" piston stroke and develop approximately 1,400 i.h.p. at 125 r.p.m. At this point it must be mentioned that the engine in each ship was installed without having undergone any shop tests, as also is the custom of the Werkspoor Works, and as we believe will be done with the New York-Werkspoor 2,000 i.h.p. Diesel now completing at Camden, N. J. This, of course, indicates the owner's and builder's satisfaction that sufficient progress and experience has been made with this particular design to warrant such a step.

The performance of the engine in the "Sevilla" to date has fully justified their action. She was the first of the two boats to go to sea, having been put in service last November. Our last report was dated the end of March when she had been in continuous operation for four months and fourteen days. In that period she covered 11,738 nautical-miles on a total fuel-consumption for all purposes of 234 tons of oil-fuel or 0.33 pound per i.h.p. hour. This consumption includes all fuel used in port when loading four cargoes and discharging five cargoes by the ship's own electric winches. It works out at about 50 miles per ton of oil. There has been no involuntary stop of the machinery, although the "Segovia" has led steamers breaking ice through Norwegian fjords.

Before discussing the details of the North Eastern-Werkspoor design we will give the general dimensions of the vessel which, by the way, will be in service between North Europe and the Canary Islands.

Deadweight capacity	2,000 tons.
Power	1,400 i.h.p.
Speed	11 knots.
Daily fuel-consumption (all purposes)	3½ tons.
Length	270′ 0″
Breadth	37′ 8″
Depth of bridge deck	25′ 6″
Classification	Norwegian Veritas

The vessels are of the single-deck class with combined poop, bridge and topgallant forecastle. A steel deckhouse is fitted on the



Inboard profile plan of fruit-carrying motorship "Segovia." Note the small space occupied by the engines, namely 15 frames

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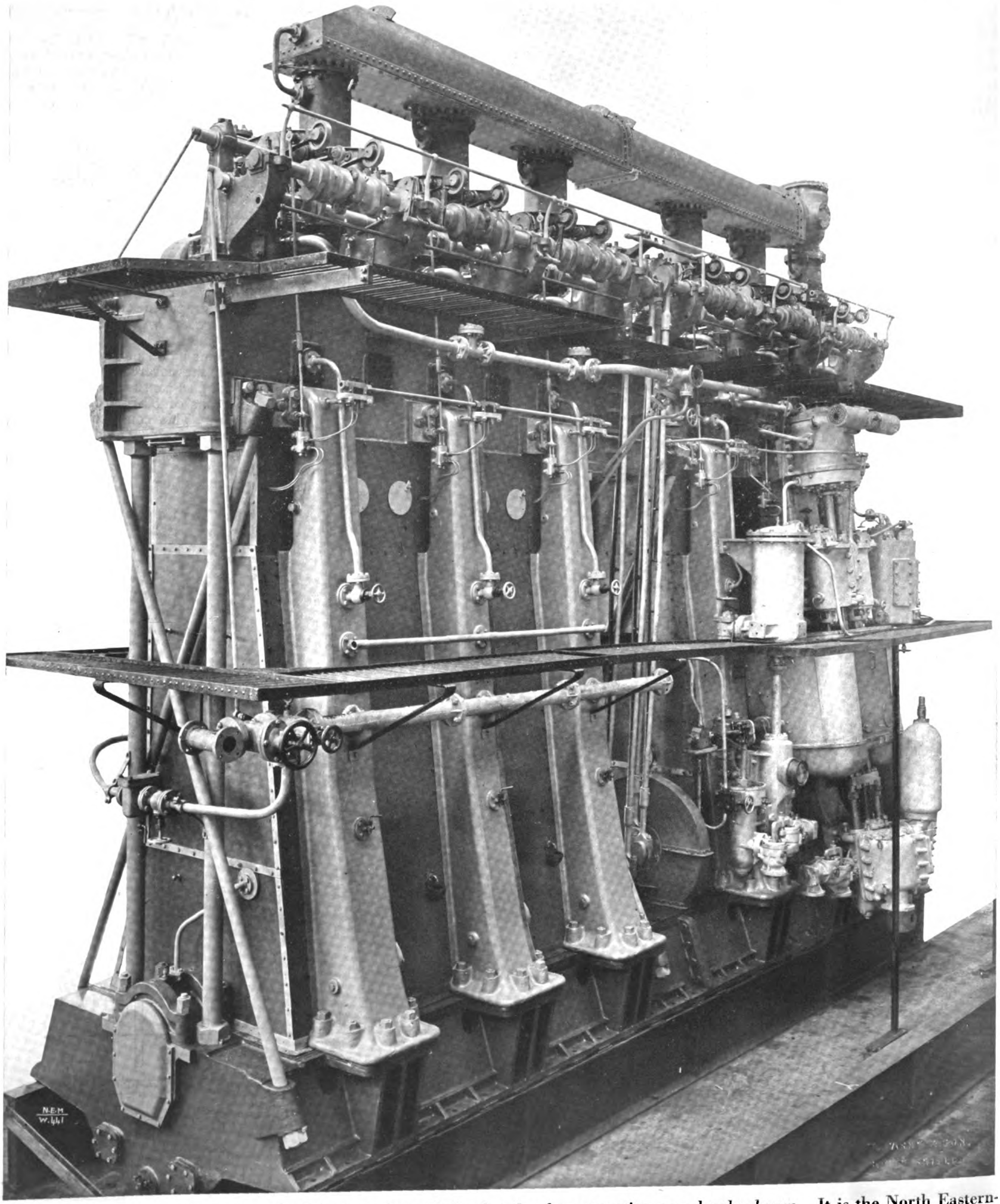
bridge amidships containing saloon, staterooms, steward's room pantry, bathroom, etc. There is a steel house on the upper bridge which contains the captain's room, wireless-room and operator's cabin. A teak charthouse is fitted on the flying-bridge above. Accommodation for the officers and engineers, messroom, bathroom, hospital, etc., is provided in sidehouses on the bridge on each side of the machinery casing. The crew is berthed in the poop with steel entrance house overhead, containing messroom, washhouses, etc. Four hatches are fitted to the holds and the most modern improvements for the handling of cargo, including double-steel tubular derricks to each hatch, and seven powerful electric winches. A Hele-Shaw Martineau electro-hydraulic steering-gear with telemotor control, and an electric windlass are also fitted. The cellular double-bottom is arranged to carry oil-fuel throughout, and a special re-



An unusually striking illustration of a Diesel engine; all the details of construction are clearly shown. It is the North Eastern-Werkspoor 1,400 i.h.p. Diesel engine of the fruit-carrying motorship "Segovia"

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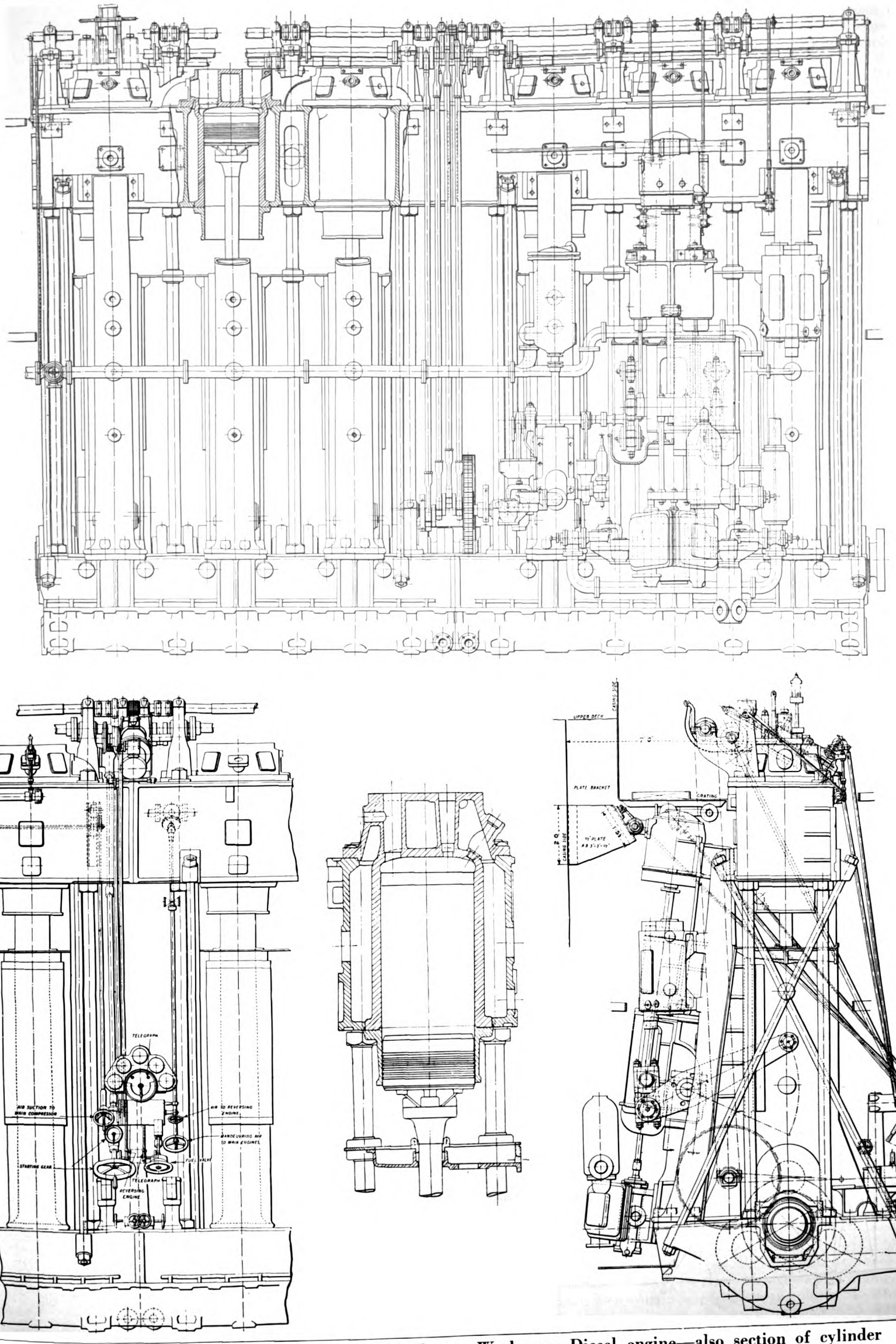

General arrangement drawings of the North Eastern-Werkspoor Diesel engine—also section of cylinder

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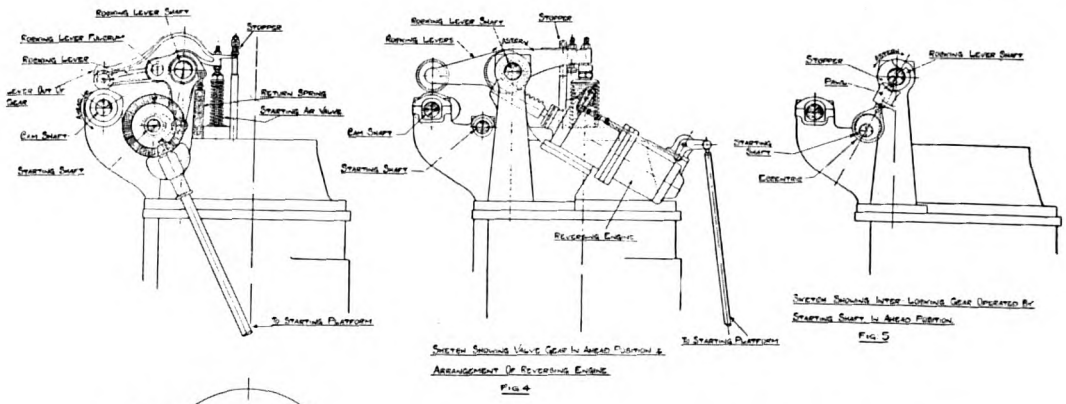
serve tank is also fitted as required by the Norwegian authorities. Each ship is rigged as a two masted fore-and-aft schooner, and has been constructed under the special survey of Det Norske Veritas, and also to the requirements of the Norwegian Law. The "Segovia" is also in service having recently seen successful sea trials.

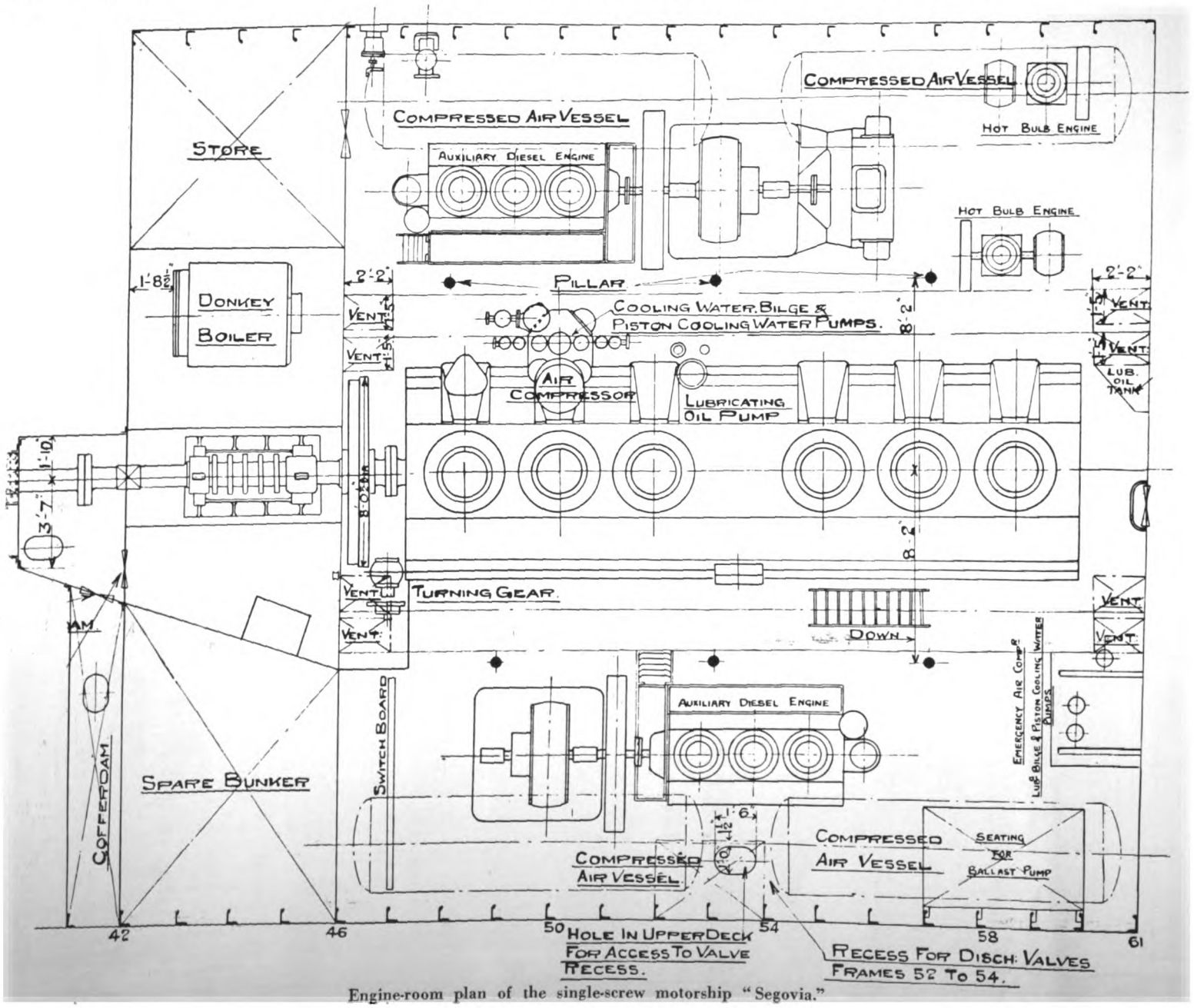
It will be noticed from the engine-room plans that very little space is required by the machinery, and that compared with most makes of Diesels of a similar power output there is a saving of at least six feet of engine-room space and over 50 tons weight, or about ten feet and 150 tons weight saving when compared with steam-engines and boilers, in addition to another twelve feet saving through the absence of necessity for a deep-tank for fuel. Thus about 22 feet of valuable cargo space must have been gained through the installation of Diesel power instead of oil-fired steam machinery. As a much smaller quantity of fuel has to be carried there also is a big gain in weight-cargo, so that the vessels have very much greater earning powers for their overall dimensions aside from their economical operation than steamers, even after allowing interest on the higher first-cost. The room required by the Diesel-engine and fly-wheel is 15 frames, and 4 frames for the horse-shoe thrust-block. By adopting the Michell or Kingsbury thrust-bearing we think that nearly two frames additional space probably could have been saved. We understand the weight of the complete engine-room machinery to be under 220 tons, the engine itself weighing about 130 tons.



Valve operating mechanism of North Eastern-Werkspoor engine

From this it must be obvious that the owner has a ship which is the equivalent of a steamer of between 400 and 600 tons larger. Because of this fact the apparent higher first-cost of the motorship is not really a higher first-cost, as the larger steamer would cost just as much, would have a fuel-bill four times as high, and would have greater general operating expenses. With such small craft these are tremendously important factors.

By referring to the engine illustrations it will be noticed that as with the Holland Werkspoor design the cylinder block, or beam, is carried on vertical steel columns running through the bed-plate and braced by diagonal steel tie-rods, and with the crossheads carried on heavy cast-iron columns, the latter being hollow and acting as intercoolers for the air-compressor. The cylinder block is in two simple castings, with a connecting piece between, forming two tanks into which three cylinders per tank are "dropped," the cylinders being cast in mushroom form with integral heads so as to ensure maximum cooling space and to avoid solid, heat-accumulating flanges and studs all around the combustion-chamber and valves where the heat and heat-stresses are the greatest. The injection-valve is off-set and thus allows about 2" of cooling-water space between itself and the exhaust-valve. The crank-pit is enclosed with oil-tight, but light, steel plates, and forced



Engine-room plan of the single-screw motorship "Segovia."

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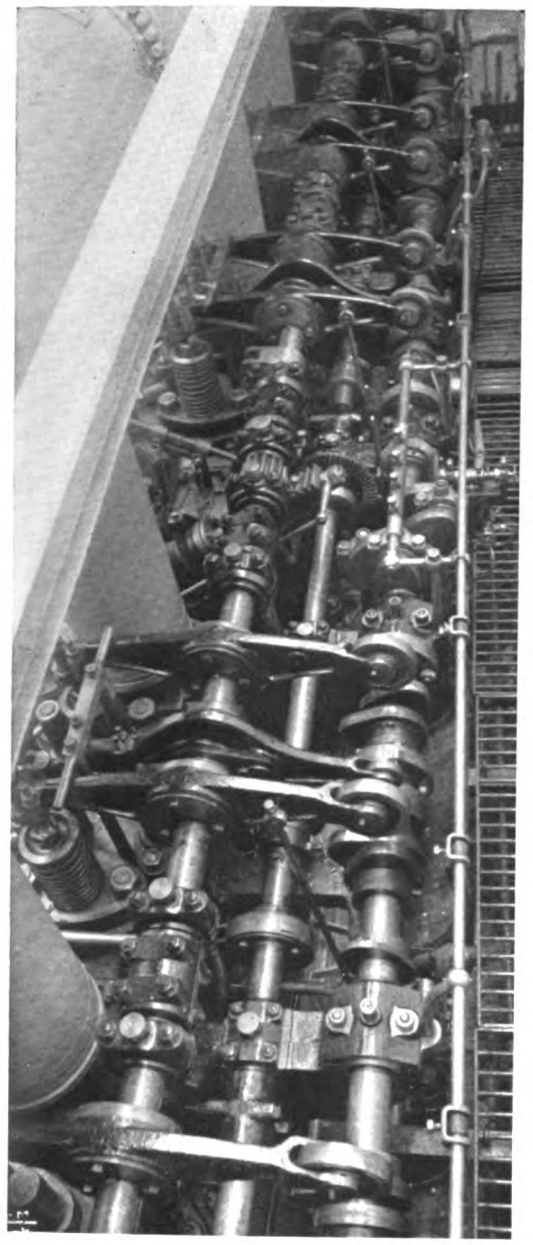


Looking from above down on to the valve gear of the North Eastern-Werkspoor Diesel engine

lubrication is supplied to all parts. For the piston lubrication a new type of mechanical lubricator has been adopted.

The lowest portion of the cylinder barrel is detachable. The piston descends into this extension piece when its crank is on the bottom dead center, so that when the extension piece is lowered the piston is entirely exposed and may be drawn out horizontally. By this device much work is saved; to inspect and replace all the pistons of a six-cylinder engine takes less than one working day.

For valve operation and reversing the same type of maneuvering mechanism as used on American and Dutch Werkspoor Diesel engines has been adopted, and which was first produced by the Amsterdam firm in 1919, supplanting the double-shaft reverse gear originally fitted on the Werkspoor Diesel engine of the single-screw tanker "Vulcanus" in 1910. Incidentally we note from the weekly shipping reports that this old motorship is still in consistent service carrying oil to and from Far East ports. She was the first ocean-going motorship to be placed in service, and the first ever visited by the editor of MOTORSHIP, the larger twin-screw Burmeister & Wain ship "Selandia" being the second afloat, also the second that we inspected. Here it is interesting to mention that altogether 15 Werkspoor motorships are single-screw vessels, namely, the "San Antonio," "Sembilan," "Vulcanus," "Juno," "Loudon," "Myer," "Siberg," "Lara," "Hestia," "Boelongan," "Bengkalis," "San Miguel," "Sevilla," "Segovia" and "Rhea." Details of all these vessels can be found in the register of 791 motorships in the MOTORSHIP YEARBOOK for 1922, price $2 from this office. Yet steam advocates rashly claim that motorships are built with twin screws because it is necessary for reliability purposes. We doubt if there is a vessel of any class afloat built since 1910 with a greater mileage record than the old "Vulcanus," taking into consideration her size and speed.

A study of the drawings of the valve gear and of the photographic view of the cylinder-heads will reveal that there is only one cam-shaft, but two cams per valve, or seven cams per cylinder, one set being for ahead running and the other for the astern movement. The valve levers, it will be noticed, are supported on eccentric bearings, which have their axis inclined to that of the shaft, so that when the latter is partially rotated the valve-rockers are lifted from one set of cams and placed upon the other. In the case of the gear for operating the fuel-valves only one cam is fitted, the lever roller taking up different positions on the cam circumferentially according to the required direction of rotation.

The reversing is simply and positively carried out by means of a servo-motor consisting of a pair of air and oil cylinders in tandem, which rotates the rocking-lever shaft through an angle of 180°, one of these extreme positions being for ahead rotation and the other for astern.

To avoid any error on the part of the engineers when starting up the main engines a patented interlocking arrangement is fitted between the engine-room telegraph and the engine control, so that if the correct reply has been given to the bridge the engines can only be set to work ahead or astern in accordance with the orders from the bridge.

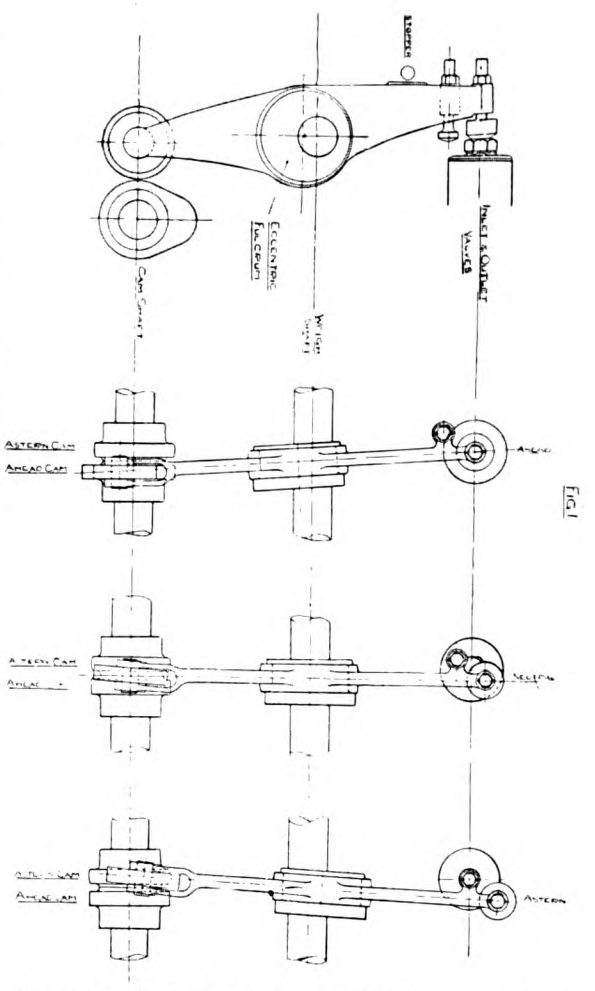
Referring to the indicator on the starting-gear illustration, one turn of the starting hand-wheel puts all six cylinders on air, a second turn places three on fuel, the other three remaining on air, a third turn places all six cylinders on fuel, and a fourth turn brings the gear back to stop position. The actual time taken to stop and reverse the engines is only about 7 seconds.

When maneuvring the starting-air rocking lever is brought down upon the cam by means of a bell-crank lever, which is moved out by a further cam arranged on the starting shaft. In a six-cylinder engine the contour of this cam differs for each set of 3 cylinders, so that one set of starting-air valves is put out of action at a time, and allows three cylinders to be running on air and three on fuel before finally putting all cylinders on to fuel.

When the engines are working, it is important that the valve gear should be exactly in its correct position, in order to insure the proper timing of the fuel injection. For this reason interlocking gear is provided and is operated as follows: When reversing the engine a stopper on the rocking-lever shaft rotates against a projection on the bearing bracket, and when all six cylinders are working on fuel, a pawl which is operated from the starting-shaft engaged with a recess in the rocking-lever shaft, and locks it in position. This arrangement also prevents the valve gear being reversed without first withdrawing the pawl, and to do this it is necessary to further rotate the starting shaft, bringing it back to the "stop" position as described above, and which at the same time by means of gearing not shown shuts off the fuel supply to the cylinders and stops the engines.

A Hawkes Hunter comparative-pressure indicator is fitted, which is driven by means of a clutch from the cam-shaft. This instrument shows at a glance the mean working pressure in any of the cylinders, and so indicates the distribution of power among the various cylinders without resource to indicator diagrams.

Auxiliaries required in connection with



Sketch of North Eastern Werkspoor diagonal valve-operating mechanism

operating the main propelling-machinery are all driven direct from the engines by means of the usual pump levers. These comprise a three-stage air-compressor, cooling-water pumps, two bilge-pumps, one of which is used for discharging the piston-cooling water overboard, a low pressure fuel-pump for charging the fuel filter, and a lubricating-oil pump which transfers the lubricating oil from the sump in the bedplate through a cooler to the gravity tanks situated high up on the forward end of the engine-room casings.

Oil fuel can be carried in the double bottom throughout the entire length of the vessel, and also in a special reserve tank situated above the tank top by the side of the thrust recess. The latter is required by Norwegian Law, and at the same time serves as a settling-tank, to which all oil is pumped before use. In this instance the fuel system known as the "common rail" has been adopted. The oil is transferred as required from the reserve tank by the L. P. fuel-pump to the fuel filter from whence it flows by gravity to the suction of the h.p. fuel-pump, which is controlled by a throttle valve operated by automatic gear on the Werkspoor patented system as follows:

An automatic balanced vessel is fitted above the level of the main cylinder fuel-valves to which the h.p. fuel-pump discharges. This vessel is balanced on a lever by a counter weight, and when the oil level rises to a predetermined height it tips the balance and shuts the suction-valves. The pressure of the injection-air in the fuel-valves is balanced by a connection to the top of the floating vessel from the same system, so that a constant head of oil is maintained which insures a regular flow to the cylinder fuel-valves; reference to Fig. 9 will make this clear.

This arrangement has several advantages. In lieu of six small fuel-pumps with a large number of small valves and working parts, a single large pump of substantial size is substituted. It is also possible with this system to provide a spare pump capable of keeping all cylinders running at full power. A certain

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amount of fuel is always on hand, and even if the pump should fail the engine will work long enough on the contents of the floating vessel to enable the engineers to start up the stand-by pump.

The auxiliary machinery is of the Diesel-Electric type throughout, the more important comprising two 150 B.H.P. three cylinder four-stroke type North Eastern-WerkSpoor Diesels, each of which drives an electric generator of 100 k.w. capacity, one being fitted at each side of the vessel. In addition the port side motor also drives auxiliary compressor which is of the Reavall quadruplex type. Arrangements are made on the switchboard connections to also enable the electric generator of this set being used as a motor for driving the auxiliary compressor. For sea use two 12 B.H.P. Kromhout surface-ignition oil-engines are fitted, which drive electric generators, one of which is for supplying current to the steering gear, and the other for ships lighting, etc.

The remaining part of the machinery installation includes ballast-pump, an oil-fuel transfer-pump, a spare combined set comprising two pumps for lubricating-oil, bilge and cooling water duties, also an emergency two stage air-compressor, a small donkey-boiler of 150 sq. ft. heating-surface, a lathe and drilling machine, and two De Laval oil purifiers, one for lubricating-oil and the other for oil fuel.

A point worth noting is that during the later stages of the fitting-out of the "Segovia," the lock-out of the Amalgamated Engineers Union, was in force, so the work was completed entirely by shipyard apprentices, to whom great credit is due for the interest and energy they displayed in their work on this vessel. So, apparently the most skilled form of labor is not always a vital factor with Diesel drive.

United Fruit Line Orders Fleet of Diesel-Electric Motorships

Contract for Three 4,000 Tons Deadweight 13½ Knot Fruit and Passenger Carriers Placed with Cammell Laird by American Firm; Fullagar Opposed-Piston Oil-Engines and Thompson-Houston Electric-Drive to Be Installed

THE most important order for Diesel-electric driven motorships yet placed by a private shipping concern has just been received by Cammell Laird & Co., Ltd., of Birkenhead, England, from the United Fruit Company of Boston, Mass., consisting of three 4,000 tons deadweight single-screw motorships, for transporting passengers and fruit between Boston and the Carribean. This is quite a bold step, but is one that we would like to see followed by other American shipowners except, of course, we naturally would prefer to see the contracts go to American shipyards and engine-builders most of whom are badly in need of additional work.

All three of these motorships will be propelled by Cammellaird-Fullagar Diesel-engines in conjunction with British Thompson-Houston electrical equipment, the latter concern, whose main plant is at Rugby, England, being associated with the International General Electric Co. of Schenectady, N. Y.; while the Diesel engines will be similar in design to the Willan Robinson-Fullagar two-cycle stationary motor illustrated on page 355 of our May issue and will be built by Cammel Laird. Four 750 brake h.p. Diesel engines driving generators will be installed abreast per vessel, then supplying power current to an electric motor direct coupled to the propeller shaft. These Diesel engines turn at 250 r.p.m. One of them has already run a three-weeks test on 14 degrees Baumé Mexican boiler-oil.

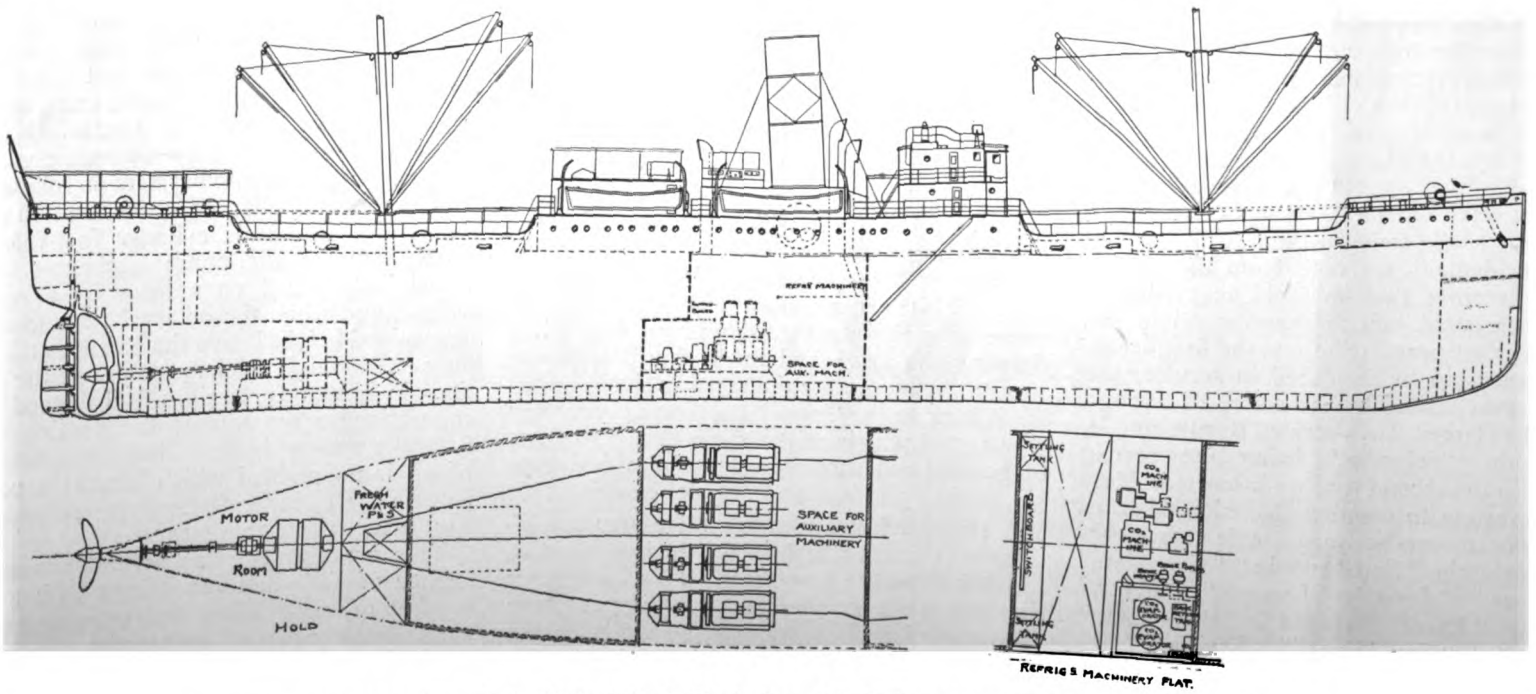
Capt. A. Davison, general manager of the Marine Dept. of the United Fruit Line, who has just returned from England where he placed the contract for the ships and machinery, advises us that attention to the particular type of Fullagar Diesel engine that they have adopted for these ships was first drawn by a page advertisement for this engine in the May, 1922, issue of MOTORSHIP, he not being aware until then that this engine had been developed for electric-drive. This advertisement, by the way, was printed inside the front cover and was inserted for one time only by the American representative of the Cammellaird-Fullagar engine. This is but another instance of advertising in this publication having a direct bearing on business worth very large amounts of money and is of great significance. A description of this engine appears on page 355 of our May number.

The ships will have the following dimensions:

Hold-capacity (inside bins)	150,000 cu. ft.
Fuel-capacity	371 tons
Fresh water capacity	73 tons
Cruising radius	10,000 n. miles
Loaded speed	13½ knots
Deadweight capacity	4,000 tons
Daily fuel-consumption (expected)	12 tons
Daily fuel-consumption in port (expected)	2 tons
Trial speed (expected	14 knots
Power (at propeller)	2,750 shaft h.p.
Power of Diesel engines	3,000 brake h.p.
Length of machinery space	45′ 0″
Length	325′ 0″
Breadth	48′ 0″
Depth	31′9″
Type of auxiliaries & deck machinery	Electric

In connection with the above dimensions we will point out that a sister reciprocating-engined steamer of the United Fruit Line has only 118,000 cubic-feet capacity or 32,000 feet less, but burns 36 tons of fuel, which is exactly three times as much, but it is evident that the builders and owners are being conservative as to the daily consumption of the motorship at sea, which we feel sure will not exceed 10½ tons, unless the main engines are run at an overload.

For the same shaft power as the steamer it is obvious that the motorships will average a much better speed, because of the even and constant propeller revolutions with Diesel-electric drive. Thus these motorships will have greater earning powers, both as to carrying capacity and speed, and will also show great operating economy in the way of fuel, water, wages and victuals. There also will be more comfort for the passengers. The higher constructional cost per deadweight ton is considerably offset by her greater capacity reducing the building cost per net-cargo ton. In other words the owners will virtually have bigger and faster ships for the dimensions and amount of constructional steel in the hull. This is rarely taken into consideration by naval-architects and consulting-engineers when making their recommendations to shipowners, probably due to all the potentialities of oil-engine power not being fully understood. All the electrical deck machinery will be built by the Sunderland Forge & Engineering Co., of Sunderland, England. The first vessel should be ready at the end of the year.



General arrangement plans of the United Fruit Line's three Diesel-electric passenger-fruit carrying motorships.

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Concrete Construction by the U. S. War Dept.

Something New and Novel as Well as Practical in Diesel-Powered Ship Construction—A Total of 43 Concrete Vessels

MUCH has been written about what marine-engineers and naval-architects expected to do in certain new types of hull construction, and it is most unfortunate that more time and energy has not been spent in actual performance and carrying out of these new ideas. There is probably some satisfaction in making the public feel that something new and important is going to be accomplished but it is infinitely more satisfactory to demonstrate an accomplishment. The reader is therefore requested at this point of discussion to forget for the moment such prejudices or opinions which have been formed as to the practicabilities of this comparatively new type of ship construction.

Having constructed more concrete ships than all other governmental agencies and American commercial agencies combined, the U. S. War Department has now completed its concrete shipbuilding program with a degree of success that deserves most careful interest and consideration. In the spring of 1918, Colonel P. M. Anderson was put in charge of the construction of concrete and other ship construction for the Transportation Service. The ships under contract at that time consisted of twelve 265′ concrete car floats, five 100′ water-tenders for harbor service, and nine 130′ motor-driven concrete freight-and-passenger vessels for harbor service. Preliminary details were given in the July issue of MOTORSHIP. Sixteen other vessels followed.

Colonel Anderson, realizing the important characteristics of concrete construction, redesigned the hull framing of all of the above vessels after the original contracts were awarded, and proceeded to construct these vessels along the lines of his own practical ideas. He visited all the yards of other government agencies on several occasions, as well as all commercial yards in the United States which had undertaken concrete vessel construction of one type or another. He states that the principal advantage in these visits was to learn what not to do, rather than what to do, in order to make a success of this type of construction.

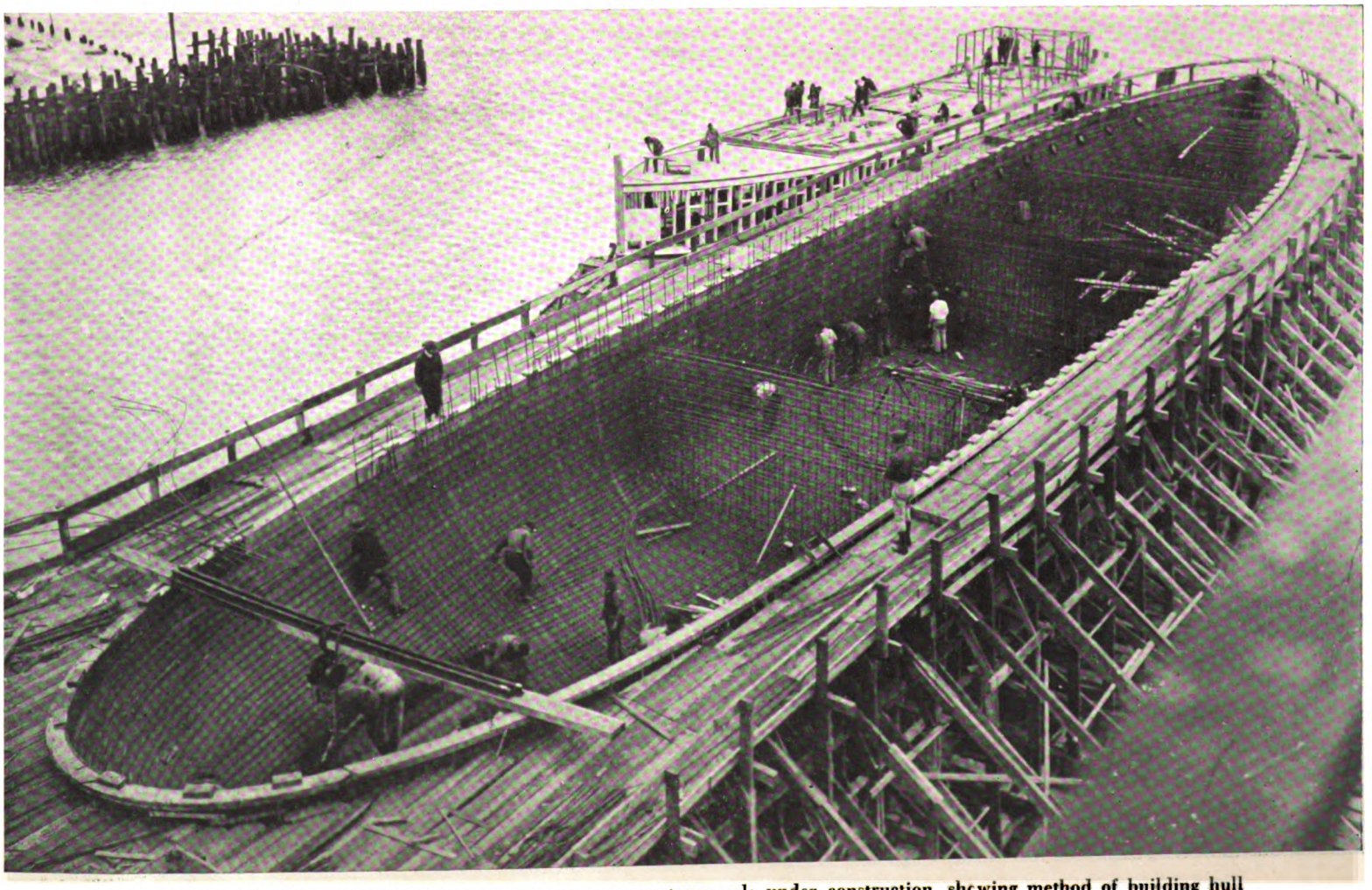
All of the foregoing craft were successfully completed and put in service. All are afloat and in excellent serviceable condition with the exception of three of the water-tenders which were abandoned in the Pacific Ocean enroute from Vancouver to San Francisco in a ninety-mile gale. A tug which had four of these craft in tow, cut three of the vessels loose and returned to port with one in tow. All of the three vessels were in first-class condition when abandoned, but could not be found at sea after the storm had abated. It was reported that the waves were filling the engine-rooms through the stacks and ultimate sinking was inevitable.

Having met with a fair degree of success on his program of concrete ship construction, Colonel Anderson became very enthusiastic and encouraged in the idea that this type of hull construction was thoroughly practical if carried out by most modern engineering methods, even though much publicity was at that time being given to the failures of other agencies. In the spring of 1920 he therefore designed and proceeded to build six 145′ 500-ton concrete oil-barges, three 310′ 3,700-ton concrete oil-tankers, and seven 150′ Diesel-engine driven, twin-screw, freight and passenger vessels. The oil-barges and oil tankers have now been successfully completed and are being put in service. This article will only describe in detail, however, the construction of the Diesel-engine propelled freight-and-passenger vessels which are showing excellent performance.

These concrete motorships are 150′ long between perpendiculars and have a molded depth of 13′ and breadth of 28′. They are twin-screw, fitted with Winton eight-cylinder four-cycle Diesel engines having a rating of 450 H.P. each. Two Winton three-cylinder Diesel engines are installed, direct-connected to 25 K.W. 125 volt Westinghouse direct-current generators for operating lighting system and auxiliaries. The auxiliaries consist of a Westinghouse motor-driven oil pump, a motor-driven auxiliary compressor, a motor-driven steering-gear, and a motor-driven anchor winch. The vessel has a draft forward of 8½′ and a draft aft of 10′. Propellers are

EDITORIAL NOTE

In the July number of MOTORSHIP some preliminary and exclusive details were published concerning the U. S. War Department's concrete motorship fleet. In this issue we are enabled to give the first complete story regarding the construction of these interesting vessels. It would seem that up to a certain size the concrete motor-vessel is practical, and that the failure of the Shipping Board's concrete ship program was due, not to concrete as a material for hulls, but to hasty construction, lack of experience and suitable type of machinery, and to too large a vessel.



One of the War Department's concrete passenger-cargo motor-vessels under construction, showing method of building hull

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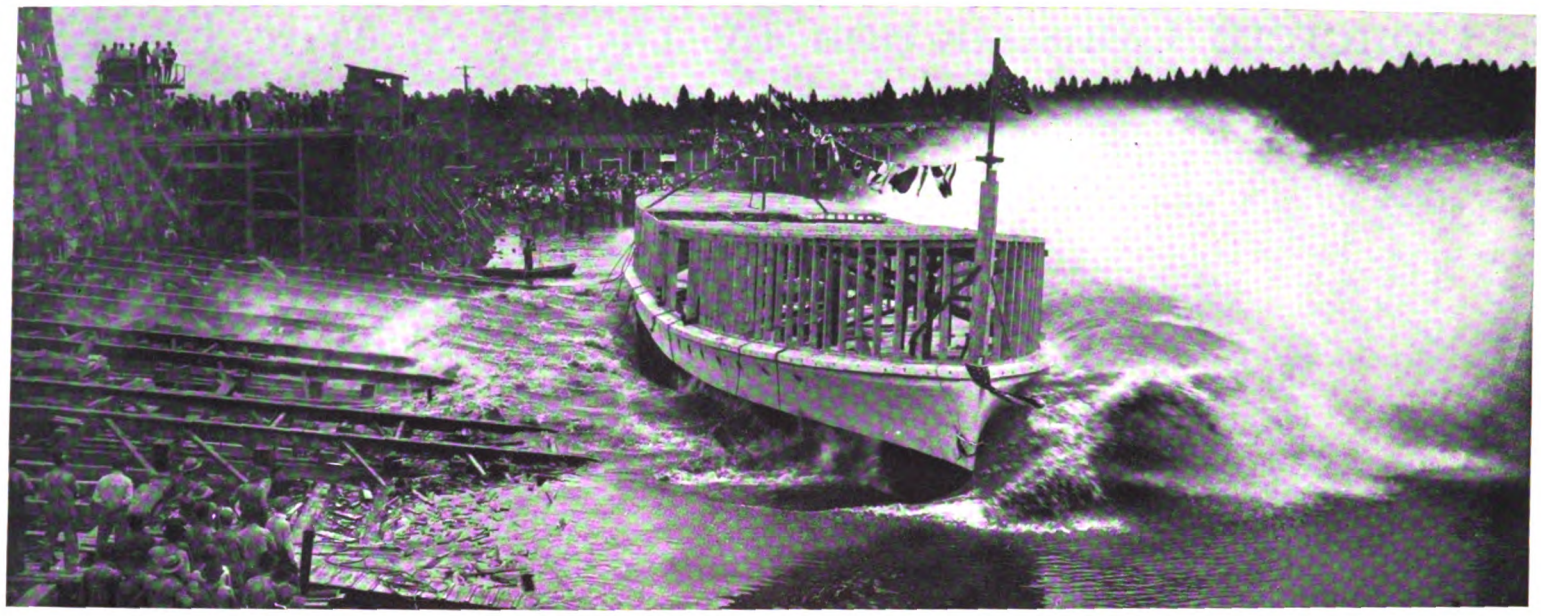


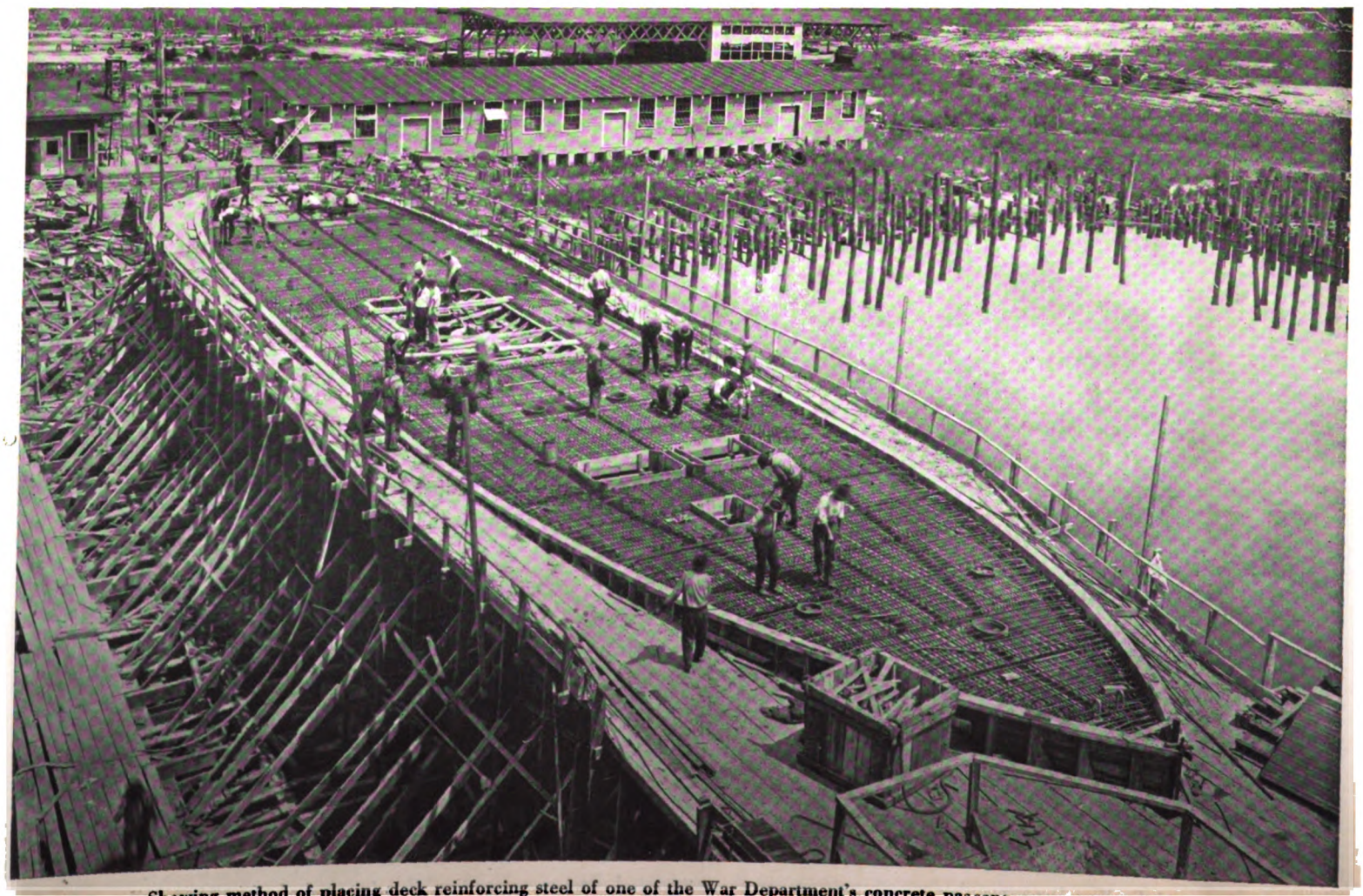
Launch of one of the U. S. War Department's concrete motorships, Mrs. P. M. Anderson, sponsor

semi-steel, 3 blade type, 6′ 8″ diameter and 6′ 6″ pitch turning at a maximum speed of 230 R. P. M. The engines are direct reversible and are direct connected to the main shafts, and developed a maximum of 587 horsepower on the block at 260 R.P.M. The average fuel-consumption of these engines at all ranges of normal operation is 0.44 gallon per shaft horse-power hour. These vessels have developed a maximum speed of 15.2 knots.

The first of these vessels to be placed in operation, namely, the "Gen. D. H. Rucker," which has been operating on the Potomac River between Washington, D. C. and Fort Washington, Md., since Sept. 1, 1921, is making an average speed of 12½ knots in daily service with her engines turning at an average of approximately 195 R.P.M. The average fuel consumption of these vessels, including the fuel consumption of the auxiliaries, for the past eight months is 4.1 gallons per n. mile. The average cost for fuel and lubricating oil to drive this vessel at the above speed in daily service, including fuel and lubricating oil required for auxiliaries and maneuvering, is 22 cents per nautical mile, which is less than one-third of the cost for fuel and lubricating oil of any similar vessel in the War Department service. In making this comparison, it is only fair to state that this operation is compared with ships of from two to three knots slower speed; from 25 per cent to 50 per cent less passenger and freight capacity, and 10 per cent to 25 per cent less displacement.

The War Department is now completing two other ships of identical size and type built with steel hulls equipped with oil-fired boilers and twin-screw triple-expansion engines. When these vessels are completed, it is hoped that a direct comparison will be published by MOTORSHIP showing the relative cost of operation of the steam-propelled steel hulls with those of concrete hulls, Diesel engine propelled, both constructed on the same lines and displacement.

Colonel Anderson considered that this vessel was too large for hand steering and since there was no steam available for the operation of established steam steering-gears, and not being able to purchase electric steering-gears in the open market, he proceeded to design a steering-gear fitted with Cutler Hammer control which was constructed by National Hoisting Engine Co. This steering-gear consists of a grooved cable-drum driven by a 30-inch worm gear, meshing with a 3-inch bronze worm carried in an oil proof case and direct connected to a 7½ h.p. direct-current motor. The controller is of the standard Cutler Hammer elevator type, designed for reversing direction of rotation at will by means



Showing method of placing deck reinforcing steel of one of the War Department's concrete passenger cargo motorships

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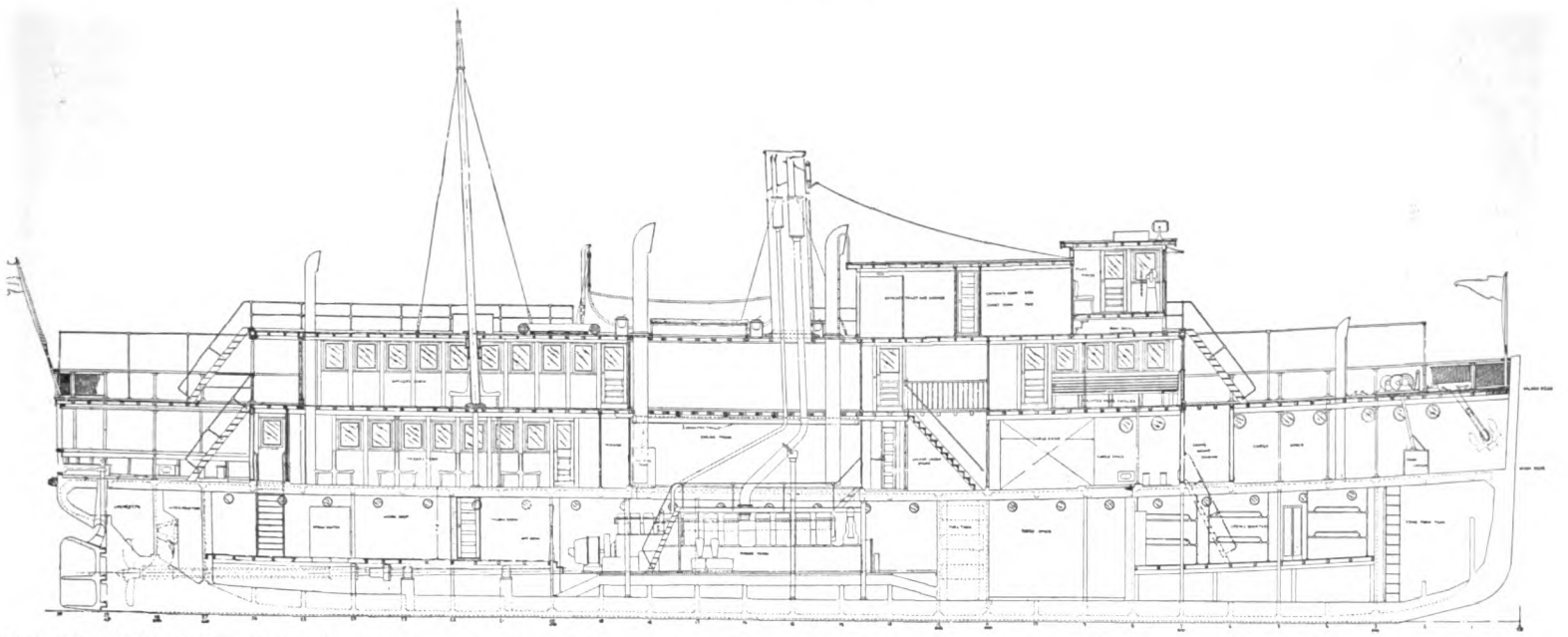
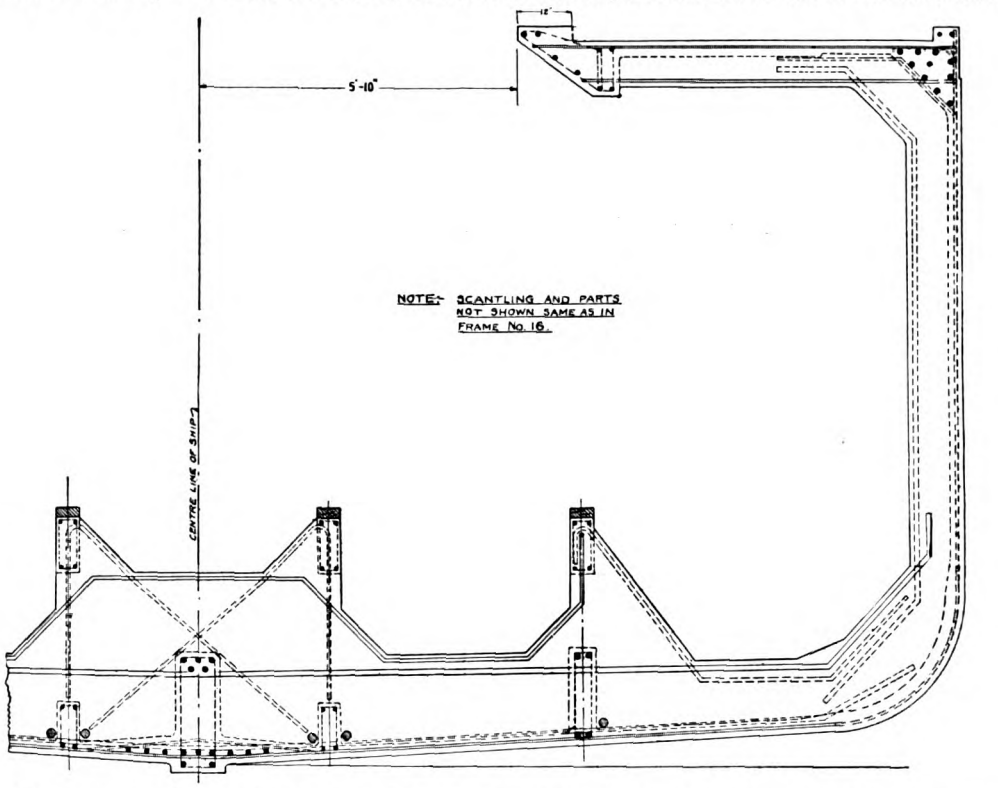


Inboard profile of the "Gen. D. H. Rucker" showing the Winton-Diesel engines. Note the truss-construction of the engine foundations which eliminate vibration

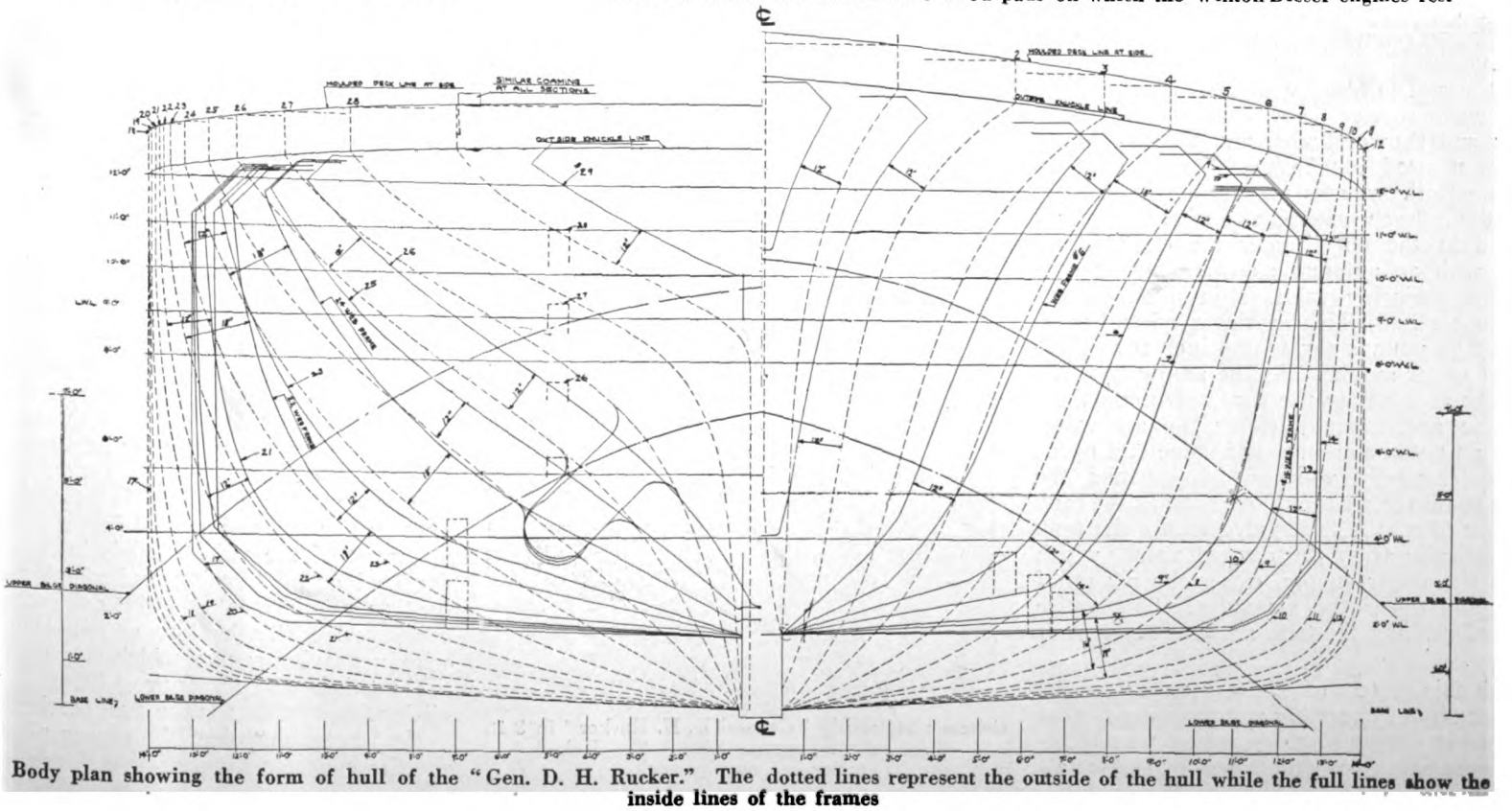
of a double-throw switch located in the pilot house. A McNab electric indicator is installed in the pilot house which indicates the exact position of the rudder. The pilot makes contact with the double throw switch and the rudder moves in one direction until the switch contact is broken.

When the switch is thrown in an opposite direction, current is reversed in the motor by means of the controller and the rudder moves in the opposite direction until the circuit is broken or until the rudder is hard over. The rudder can be stopped in any position and the position is at all times shown by the McNab indicator. The steering-gear is capable of putting the rudder from hard-over to hard-over in fifteen seconds under normal full-speed operation.

The main engines can be directly reversed from full-speed ahead to full-speed astern in six seconds and with the combination of engine reverse mechanism and rudder control, the maneuvering qualities of this vessel are declared as near perfect as it is possible to design. The anchor winch is of the type manufactured by the American Engineering Company, and is fitted with a spur gear driven 5 h.p. motor with weather proof type of electrical controller, mounted adjacent to the anchor winch on forward upper deck. This anchor



Transverse section of the "Gen. D. H. Rucker" through the engine-foundations. Note the effective use of material and the wood pads on which the Winton-Diesel engines rest



Body plan showing the form of hull of the "Gen. D. H. Rucker." The dotted lines represent the outside of the hull while the full lines show the inside lines of the frames

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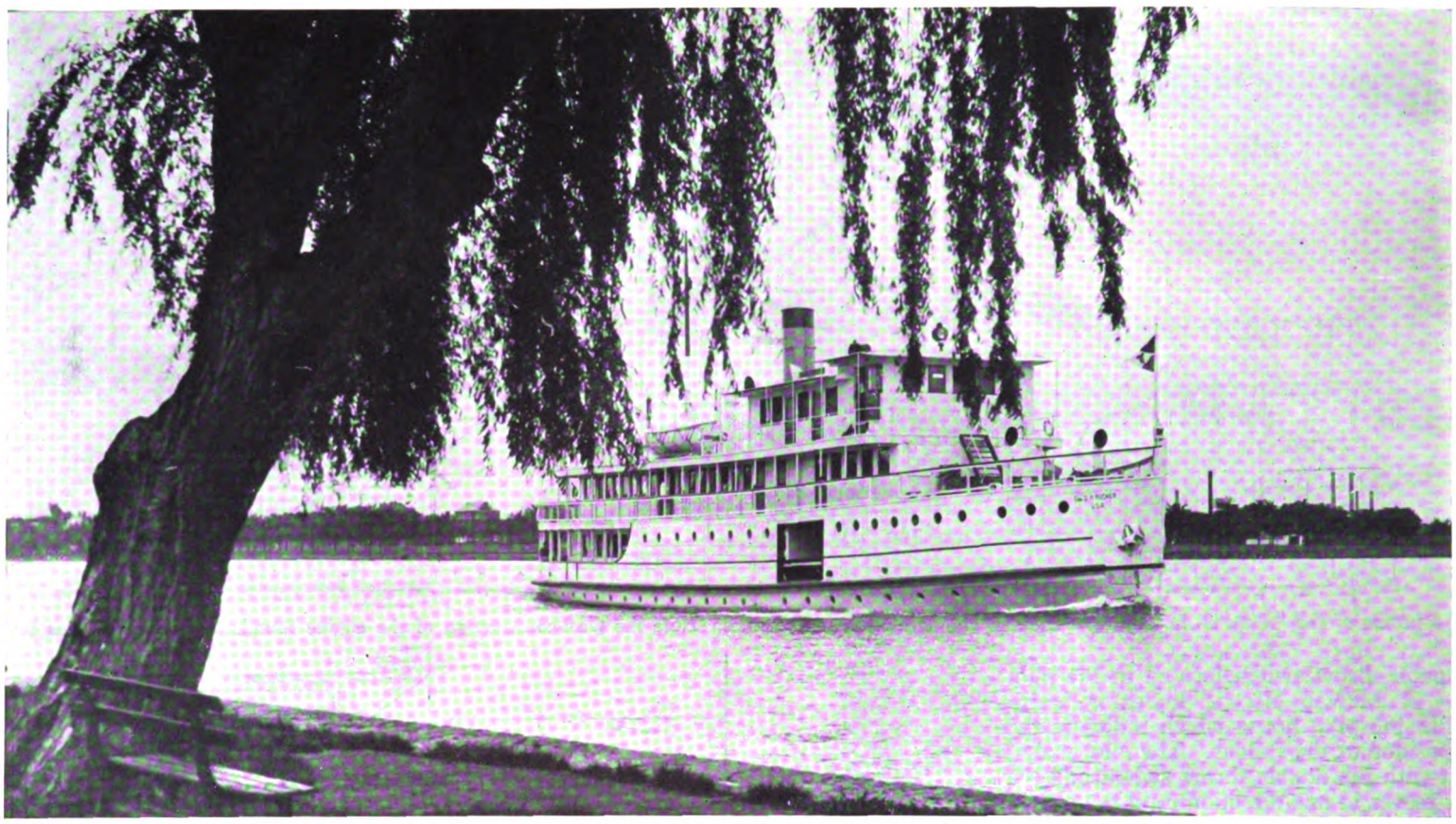

Three-quarter bow view of the War Department's concrete passenger cargo motorship "General D. H. Rucker." Max. Speed 15.2 Knots

winch is fitted with two cat heads and sprockets for handling both anchors separately or simultaneously. In addition the main shaft is provided with a taper cone for handling lines in docking the vessel.

The auxiliary motor-driven air-compressor is of a 3-cylinder, gear-cycle water-cooled Winton type, geared to a 5 h.p. G-E. motor and is used for replenishing starting and ignition air in case of emergency. The main engines and also the auxiliary engines are fitted with a direct-connected air-compressor with a normal capacity for supplying required ignition and starting air.

The starting system consists of one large air bottle 18 inches in diameter and 20 feet long, carrying a normal pressure of 600 pounds per square inch; two injection-air bottles are installed; however, only one is required for normal operation with all units in service, the second bottle being held in reserve in case of emergency. Injection-air bottles carry normally 1,200 pounds of air for injection purposes.

The vessel is fitted with both sanitary and fresh water service. Fresh water is for lavatories and shower baths, and the salt water system is used for flushing purposes in the toilets. Both systems are automatic in their operation. Each system has a steel water tank located in the bilge under the engine-room fitted with an automatic air and water control. A reducing valve is installed on the starting-air line which carries a normal pressure of 30 pounds per square inch for operation of water system. As the auxiliary water tanks become empty the float valve contained in same automatically closes the air valve, opens an automatic air relief valve and opens the water-supply valve which permits the water to fill the air tank. As soon as the tank becomes filled, the float valve within the tank automatically trips the control valve, which closes the water supply, closes the air relief valve and opens the air valve. The entire work of refilling the tank requires about four minutes.

With this system of sanitary water control the necessity of operating any pumping system with power from an outside source when auxiliary generators are shut down, or the installation of storage batteries, is eleminated. Therefore as soon as the vessel is docked and electric current is no longer required for lighting or for operation of winch or steering gear, the entire power plant including auxiliaries is shut down and fuel consumption ceases.

The starting and control of machinery on this vessel is considered as near perfect as can be hoped for. It is possible, and it has been demonstrated by actual performance that the entire crew can march aboard this ship after it has been laying at the dock for twenty-four hours and all units are cold, for each man to take his post and give all signals in an orderly manner and be going full-speed ahead in six minutes. The engines require no pre-heating or priming for starting in the coldest weather conditions. Their performance on the motorship RUCKER for the past eight months has been most satisfactory without any appreciable cost of repair, except for three cylinders which had to be replaced on these vessels on the first 9,000 miles of service. These engines can be started and stopped, however, on seven cylinders, so that a broken cylinder does not put the unit entirely out of commission. A cylinder can be replaced by a new one by the ship's crew in twenty-four hours. The failure of the engine cylinders is not considered serious as the original design of cylinder castings is a distinct violation of best engineering principles and the defects in design can be remedied at a very nominal cost. Some difficulty has been experienced with piston-rings in the high stage of the air compressor; however, such difficulties have been minor and readily repaired by the ship's crew.

Concrete motorship "General D. H. Rucker" in 8 ft. of ice on the Potomac River. She docked under her own power

Cylinder heads were first removed from the main engines on the motorship "Rucker" after 7,000 miles of navigation and the intake valves were found to be in the same condition as when installed. The Nichrome exhaust valves were slightly blackened on the seats and showed very light marks but were not of sufficient depth to be discernible with the most delicate instrument. A few turns of grinding restored their original polished surface. The cylinder-heads were removed and valves ground on both the twin main propelling engines by the ship's crew and replaced ready for service in two days' time. It is not considered that this repair and over-haul need be done with this type of engine oftener than every 8,000 miles of navigation.

There being no steam available for heating purposes from the main power plant, and it being inadvisable to employ the use of engine jacket cooling-water for heating purposes on account of the intermittent service of these vessels, a standard type of Hart-Crouse steam-heating boiler was installed in the after compartment of the vessel. This boiler is fitted for coal or oil burning and supplies normal heating requirements in the coldest weather conditions. This heating system is designed with a gravity return which has proven entirely satisfactory in service. There is a fuel-oil heating-system for the fuel service.

No less unique than the power plant itself are the concrete hulls of these vessels. The

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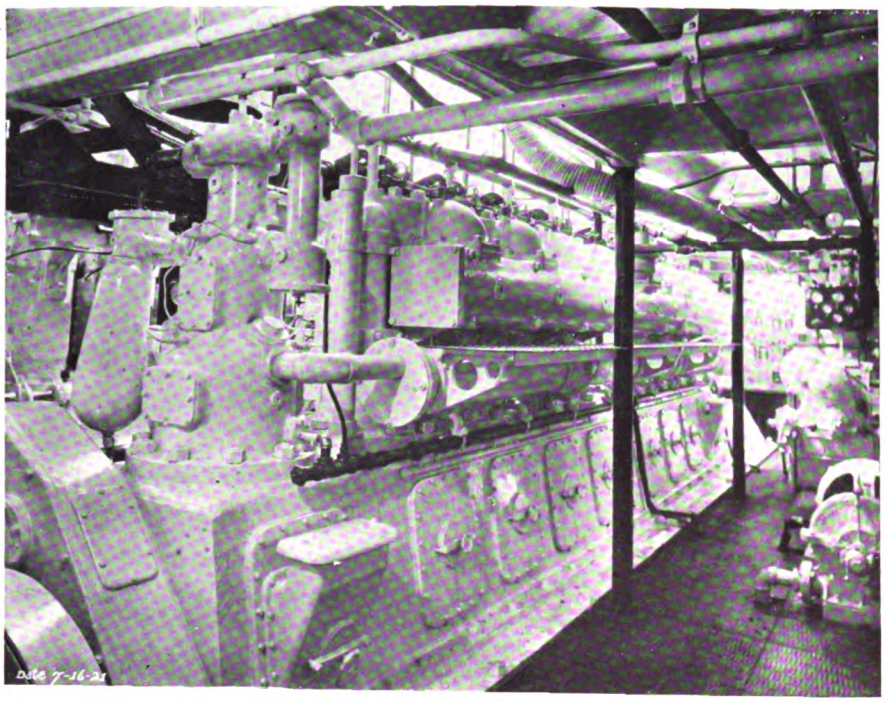
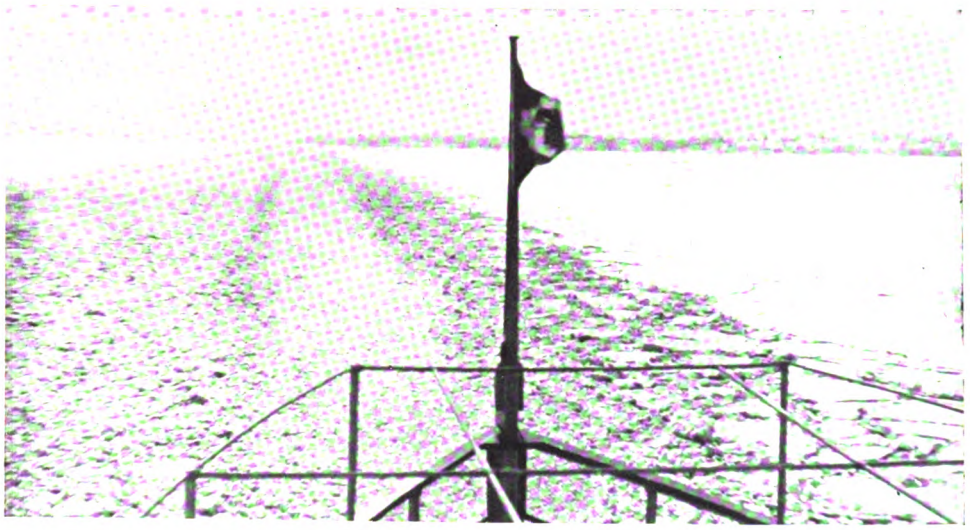


The Winton-Diesel Installation of the Concrete Vessel "Gen. D. H. Rucker"

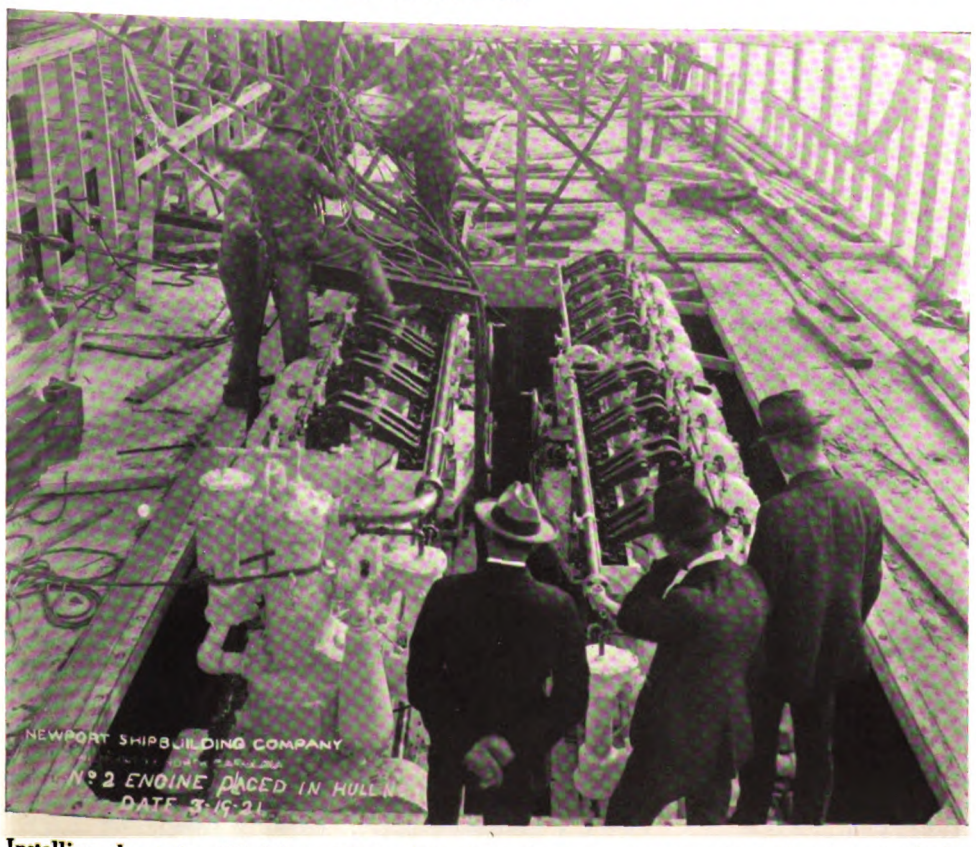
hulls are designed with transverse frames spaced 5 feet on centers, and a center line keel runs from stem to stern and projects below the shell of the vessel 1½ inches to facilitate the placing of keel blocks. Two sister keelsons are installed 6 inches on each side of the keel. The deck is similarly framed with a heavily reinforced coaming around the engine-room hatch and lateral, longitudinal girders spaced 5 feet on centers extend from bow to stern. The hull shell of the vessel is heavily reinforced much as indicated in one of the illustrations. The side walls of the hull have an average thickness of 2¾ inches.

A special system of reinforcement of hull steel is employed which makes it possible to reduce these side walls to the thicknesses indicated without danger of leakage or failure. The strength of these hull slabs can best be appreciated when it is known that during the month of January, 1922, the motorship "Rucker" operated continuously at full-speed on the Potomac River through solid new ice as much as 5½ inches in thickness, and through slush ice which was of sufficient depth to temporarily cause the clogging-up of the sea suctions located 8½ feet below the surface. This ice continued in various thicknesses for over one month and during this entire period the vessel was in continuous operation and it is significant that there is not the least sign of erosion or abrasion to the hull surface, although no protection, such as steel ice plates has been used. Board marks of the hull forms, into which the concrete was poured, are as clearly visible today as when the vessel left the contractor's dock. The concrete hull is made very dense by special methods of handling, mixing and treating of the concrete, and by certain applications of lapidolith after the concrete has become seasoned. But, it is very evident that Colonel Anderson is not telling *all* the secrets of concrete hull construction which has met with such marked success.

The motorship "Rucker" was launched at Wilmington, N. C., on May 23, 1921, and has remained absolutely dry without an apparent drop of seepage up to the present time. This is most significant in view of the fact that it was in heavy ice service for more than thirty days. The forecastle remains absolutely dry and the original oil paint which was applied to the interior of the hull soon after launching, is still intact without any damage apparent.



View taken from the stern from one of the War Department's concrete motorships showing the ice broken-up by the vessel



Installing the twin 450 b.h.p. Winton-Diesel engines in the concrete hull of one of the War Department's passenger-cargo motorships

Although Colonel Anderson has had personal charge of this construction and has designed these vessels in their entirety from stem to stern, and has prepared all plans and specifications for their construction, he has not hesitated to highly commend the most excellent work done by Mr. R. H. Arnold, contractor, in carrying out the details of construction along the most scientific as well as practical engineering methods. Col. Anderson largely attributes the success of this construction to the contractor's willingness to carry on the work by various methods which seemed to contribute to the ultimate success of the construction, and to carry out Col. Anderson's ideas of the best methods of construction, even though the cost of such methods were greatly in excess of what they would have been had a more strict interpretation of the contract requirements been insisted upon by the contractor. Colonel Anderson considers Mr. Arnold as the most competent contractor of concrete craft in America today, and attributes his competency in this line to his very broad experience in concrete building and other concrete construction. Mr. Arnold has constructed nineteen of the forty-three concrete ships built for the War Department.

Important as it may seem to know the best practices in ship design, it is equally and perhaps more important on this type of construction to know the characteristics of reinforced

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concrete. Col. Anderson has had a great deal of practical experience on reinforced concrete construction, but he shares his success on this construction work with the firm of Whittelsey & Whittelsey, naval architects of New York City, who prepared the detailed working plans based on Col. Anderson's calculations and designs. Col. Anderson considers that Whittelsey & Whittelsey are deserving of highest praise for their careful attention to the multitude of important details on their drawing for the proper guidance of the workmen.

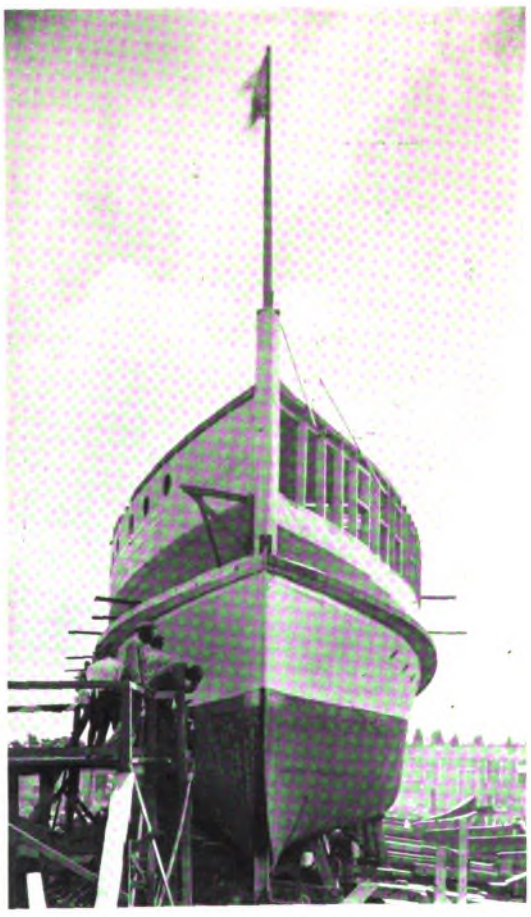
The lines of these vessels are most significant and the reader's attention is directed to the illustration showing a bow view before launching. The lines were most carefully worked out by Col. Anderson so that at a certain speed the bow wave could be rolled away from the ship in such a way as to offer the minimum resistance. This has been accomplished in a most successful manner as evidenced by the vessel in actual operation at full speed when there is a hollow cone formed by the bow wave for a distance of approximately twenty feet. The stern lines are equally well designed giving a steady and solid flow of water to the wheels, all of which contributes to the marked speed obtained with the power developed.

It should be noted that the hull resistance of a concrete ship is considerably less than that of a steel ship of the same lines and this has been proven by actual demonstration of similar vessels, and it is expected that it will be proven again if a comparison can be made between this type of concrete vessel and the steel vessel of similar lines now nearing completion. It is estimated that the frictional resistance of the concrete one is from 5% to 10% less than that of the steel hull.

The advantage of the concrete hull consists principally in the fact that same can be constructed at a cost of 60% of that of a similar steel hull of equal strength and can be constructed in one-half the time required for the construction of a steel hull. The design can be made such that the ultimate deadweight displacement will not exceed the steel hull by more than 12%, and this is not a serious condition in view of the fact that it becomes necessary in most instances to ballast the steel hull, making it practically the same weight as that of the concrete hull. Another important advantage of the concrete hull for certain types of vessels is that no scaling or painting is necessary to prevent corrosion. Concrete hulls which were completed by Col. Anderson almost four years ago and have been in salt water during the entire time, show no signs of corrosion of the steel or erosion of the concrete. All of the concrete ships constructed by the War Department have at least three-quarter inch of concrete to project over the outermost layer of reinforcing steel and it is the theory of the Department that any capillary attraction which might permit the salt water to come in contact with the reinforcing steel, becomes neutralized of its salt before it reaches the steel proper. The capillary attraction permits a small quantity of water to penetrate the outer surface of the hull but this water when once absorbed into this surface is held by this capillary attraction and no circulation takes place.

In case of fracture of any part of the hull, it is a simple matter to slip a dam over the side of the vessel, shut out the water and plaster fresh concrete in place after the broken pieces have been carefully removed. Facilities for repair of such damages far exceed that of the steel ship which must necessarily be drydocked for such repairs. The item of cost of scaling and painting to prevent corrosion alone is worthy of consideration since it is entirely eliminated in a concrete hull and a constant source of expense on a steel hull.

Col. Anderson was Chief of the Construction, Maintenance and Repair Division of the Army Transportation Service during the war and was later appointed Chief of the Construction Division of the Inland and Coastwise Waterways Service. He has recently resigned from his latter position to engage in consulting engineering practice, with offices in the Southern Building at Washington, D. C. He has had a very broad engineering experience in both marine and stationary engineering and is a member of the Society of American Military Engineers, member of Society of Naval Architects and Marine Engineers, member American Society of Mechanical Engineers, and a member of American Institute of Electrical Engineers.



Bow view of the concrete motorship "General D. H. Rucker" showing the attractive lines of the hull

Stern view of one of the War Department's concrete motorships showing propeller and rudder

ANOTHER DIESEL-ENGINED YACHT

Now under construction at the yard of the Newport News Shipbuilding & Dry Dock Co. is the twin-screw motor-yacht "Ohio," building to the order of a prominent newspaper magnate from designs by Cox & Stevens. Twin Winton Diesel-engines of 350 b.h.p. will propel this vessel, which is 172′ long, 26′ breadth and 11′ draft. This is the second Winton-Diesel yacht to be built at Newport News.

MOTORSHIP "DOMINION MILLER" AT SAVANNAH

Recently the Furness-Withy Company's new single-screw motorship "Dominion Miller" arrived at Savannah and completed loading. This vessel it may be remembered was built and Diesel-engined by Doxfords of Sunderland, and is of their standard type, the main engine developing 3,000 i.h.p. from six opposed-piston cylinders at 77 r.p.m. The cubic-capacity of this ship's cargo holds is 563,470 cu.ft. of grain or 514,720 cu. ft. of bales. In addition there is a fuel-capacity of 1,132 tons of oil at 39 cu.ft. to the ton. At present Diesel-oil supplied by the Anglo-American Oil Co. is being used and this will be continued for a while. Afterwards a mixture of Diesel-oil and boiler-oil will be used, and then boiler-oil will follow. The daily fuel-consumption is 9½ tons per day. Another report states that she has used boiler-oil for the last 4,700 miles of the 16,000 miles covered to date.

PERFORMANCE OF THE M.S. "GEISHA"

Writing to Werkspoor on May 26, 1922, Capt. Bugge of the Werkspoor Diesel engined motorship "Geisha" stated that since her voyage to Bombay, this vessel made a trip in ballast to southeast Australia where she loaded a cargo of wheat and on the return passed through the Suez Canal, first calling at Aden. Then she proceeded to Novorossisk in the Black Sea where she discharged her cargo. Then she sailed in ballast for Tunis and loaded phosphate for Stettin. She will go through the Kiel Canal. Capt. Bugge also stated that everything went exceptionally well, to their entire satisfaction.

PERFORMANCE OF FIVE VICKERS DIESEL-ENGINED TANKERS

Recently we secured a record of the performances to date of five Diesel-driven tankers built and engined by the Vickers Company of England. The "Narragansett" was the first of these vessels to be placed in service. The other vessels were constructed afterwards, the latest being the "Scottish Minstrel." Each of these vessels has a loaded displacement of 14,000 tons and a contract trial speed of 10½ knots, so the record to date is most interesting. It will be noted that in no case does the daily fuel-consumption run as high as 10 tons, two boats averaging less than 9 tons.

Name of Vessel	*Miles*	*Average Speed Knots*	*Engine Fuel Tons*	*Record to*
Narragansett	104,800	10.12	9.7	26/5/22
Seminole	69,150	10.34	9.8	25/5/22
Scottish Standard	38,800	9.95	8.92	29/4/22
Scottish Maiden..	29,760	10.16	8.83	12/5/22
Scottish Minstrel.	9,925	10.23	9.64	21/4/22

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Performances of Two Sulzer-Engined Vessels

Maiden Voyage of Norway's Largest Merchant Ship, and the Reliable Operation of a Spanish-Owned Tanker

WITHIN a few weeks of each other two newly-built two-cycle engined motorships crossed the Atlantic to our shores, both of which are fitted with engines of Sulzer design; but in one case the machinery was constructed in Switzerland by Sulzer Freres whereas the other ship had her motors made in England by a licensee. These craft are the Norwegian freighter "Handicap" and the Spanish tanker "Conde De Churruca." The performance of both ships to date fully vindicate the contention of two-cycle advocates that this type of Diesel when properly designed and constructed is just as reliable as any four-cycle oil-engine under ordinary sea-going conditions.

The "Handicap"

Results of the "Handicap's" maiden voyage show a record of reliability and economy sufficient to satisfy the most skeptical shipowner. This vessel was described and illustrated in the October, 1921, and February, 1922, issues of MOTORSHIP, and just as in Denmark and Sweden the largest merchantships yet constructed are motorships so is the motorship "Handicap" the largest domestic-built vessel in the Norwegian merchant-marine, being of 9,000 tons deadweight and 415 ft. long 54 ft. 6 in. breadth and 36 ft. 11 in. depth. She is powered with two four-cylinder Sulzer engines of 1,350 shaft h.p. each having cylinders 23.622 diameter by 48.732 stroke operating at 100 r.p.m. Her engine-room also contains two 330 b.h.p. Sulzer Diesel auxiliary-engines each driving 220 k.w. 220-volt electric generators, these furnishing power for all auxiliaries on deck and below, for the "Handicap" has no donkey-boiler. Electrically driven turbo-blowers for scavenging are also provided, this particular set of engines being the first large motorship to have them.

Following her trials early last December she went into service, her owner, Bruusgaard, Kiosterud & Co., of Drammen, sending her on a voyage to Argentine. She sailed from Stavanger, near which port she had been built by the Rosenburg Shipyard, Buisland, on Dec. 24 proceeded to Brixham, England, where she arrived on the 27th and departed on the 28th, arriving off Newport on the morning of the 30th, but cruised about for 12 hours until the bad weather moderated before entering and anchoring. This run to Newport was of 980 miles. On the 31st she docked and loaded 7760 tons of coal and 630 tons of fuel-oil.

From Newport she sailed on Jan. 10, 1922, for Bahia Blanca, Argentine, arriving on Feb. 4th, after a perfect run of 6,300 nautical miles. A mean-speed of 10¾ knots on a total fuel-consumption of 9.4 tons per day, meaning lighting, cooking, heating, steering, etc., was recorded for the voyage from Stavanger to Bahia Blanca. It required 14 days to discharge cargo, which work was carried out without interruption by her electric winches, upon completion of which work the "Handicap" proceeded to Perto Galvan on Feb. 24th, but could not load her cargo of grain until March 1st. While in port many captains and engineers of steamers came aboard and were most favorably impressed with both the ship and her Sulzer-Diesel machinery. One of the features which the "Handicap's" chief-engineer was particularly pleased to show visiting engineers was the arrangement of the manoeuvring-gear on the top-platform in the engine-room. The captain is proud of his vessel, and of her comparatively high-speed on a very low fuel-consumption.

After completing loading of 8,660 tons of grain she sailed on March 9th, requiring no tug-boat, although 33 manoeuvres were recorded for the port engine and 31 for the starboard engine. Upon arrival at St. Vincent, W. I., orders were received to proceed to Hamburg, Germany, and on this trans-Atlantic run heavy seas and head winds were encountered so that the speed was reduced to 8¾ knots. On the afternoon of April 3d it was impossible to keep the ship on her course against the exceptionally strong head winds, so she was put about and ran before it with the propellers turning about 60 r.p.m. until early the following morning. On the 6th, a race with the four-cycle engined motorship "Peru," which the "Handicap" won, added to the interest of the trip. Then on April 8th she was docked at Hamburg. The run up the river to the city was made without the aid of a tug, and as the channel is far from straight this trip required 53 maneuvres on the port engine and 51 on the starboard engine. For this run of 6,943 nautical miles from Bahia Blanca to Hamburg the average speed was 10 knots and the total daily fuel-consumption for all purposes was 10.2 tons, both these figures being somewhat adversely affected by the very severe weather conditions.

Thus was covered a distance of 14,313 nautical miles without engine trouble of any sort, temperatures throughout the engines were normal and the whole voyage reflects credit to the builders of the machinery and to the engineering staff of the ship. Her engine-room crew consists of 14 men as follows: three engineers, three assistant-engineers, three greasers, two electricians, one mechanic, and two apprentices. The log showed the following record of machinery operation on the voyage:

Running Hours and Manoeuvres from Dec. 24, 1921, to Jan. 8, 1922.

	Running Hours	No. of Manoeuvres
Port engine	118	110
Starboard engine	130	122
Port auxiliary-engine	116	...
Starboard auxiliary-engine (of which 232 were continuous)	374	
Auxiliary air-compressor	22	...

Jan. 9, 1922, to Feb. 5, 1922.

	Running Hours	No. of Manoeuvres
Port engine	603	64
Starboard engine	603	80
Port auxiliary-engine	640	...
Starboard auxiliary-engine	26	...
Auxiliary air-compressor	none	...

Feb. 6, 1922, to March 3, 1922.

	Running Hours	No. of Manoeuvres
Port engine	1 hour	58
Starboard engine	1 hour	53
Port auxiliary-engine	58	...
Starboard auxiliary-engine	290	...
Auxiliary air-compressor	64	...

March 4, 1922, to April 8, 1922.

	Running Hours	No. of Manoeuvres
Port engine	702	101
Starboard engine	707	97
Port auxiliary-engine	130	...
Starboard auxiliary-engine	662	...
Auxiliary air-compressor	15	...

The use of the main-engines for only one hour in the period from Feb. 6th to March 3d was due to the fact that she was unloading and loading cargo and merely ran from the dock at Bahia Blanca to the anchorage at Perto Galvan, where she loaded grain. It will be noted how consistently the "Handicap" entered and sailed from harbors, manoeuvring into dock, and down tortuous channels under her own power without the aid of a tug, this speaking volumes for the ability of her engines to manoeuvre at reduced revolutions with precision and reliability.

The "Conde de Churruca"

The other Sulzer-engined motorship which has been adding to the prestige of this two-cycle Diesel-engine is the Spanish tanker "Conde de Churruca," which was described and illustrated in the November, 1921, issue of MOTORSHIP. It will be remembered that she was built by Sir W. G. Armstrong, Whitworth & Co., of Newcastle-on-Tyne, England, for the Sociedad Commerciale de Oriente, of San Sebastian, Spain, and is powered with two 1,250 h.p. Armstrong-Sulzer Diesel-engines built by this firm under license. She is of 6,500 tons deadweight and the following dimensions: length over all 383 ft., length between perpendiculars 370 ft., breadth 48 ft. 7 in. and 30 ft. depth. When fully loaded her mean draft is 24 ft. 3 in. and she is constructed on the Isherwood system.

The "Conde de Churruca" has been under time-charter to the Anglo-Saxon Petroleum Co. for some months and during the last days of June arrived at Pier 14, Stapleton, Staten Island, New York harbor, where she unloaded six thousand odd gallons of oil into the depot-tanker "Pyrula," which this same company maintains at New York for ship-bunkering purposes. Immediately upon her arrival we went aboard the "Conde de Churruca," keen to learn of the performance of this vessel which we feel is being watched by those interested in determining the relative merits of the two-cycle and four-cycle engines compared with steam machinery. Not making much progress with the Spanish chief-engineer, Signr. Viga, due to our lack of knowledge of his language, we were glad to find that the ship carried an English guarantee-engineer and a couple of English assistants who are aiding the Spanish engineers in obtaining a complete knowledge of the machinery before leaving the ship in the fall. Mr. J. Rewcastle, the guarantee-engineer from Armstrong, Whitworth's shops, courteously allowed us to examine the engine-room log-book and his personal note-book with the invitation to make use of everything there, if desired.

From a careful perusal of this data we were glad to note that not a single stop was made because of engine-trouble, the entries simply covering adjustments of various parts, taking-up on bearings, joints in piping, etc., such work as the engine-room crew of any steamship is always performing. The entire engine-room crew are of the opinion that they much prefer the Diesel to the steam-engine. This crew consists of fifteen men, namely, one chief-engineer, three assistant engineers, three apprentice engineers, six oilers, pump-man and donky-boiler man, this being the regular Spanish crew; one of these engineers will also take care of the electrical equipment when the electrician of the guarantee-crew leaves.

The outstanding feature of the operation of the "Conde de Churruca" as we study her log-book seems to be the unfailing regularity and reliability of her power-plant as she ran continually from port to port without a single delay, usually departing the day after arrival, so that machinery repairs of any great extent could not have been made. Using fuel-oil of 0.87 to 0.92 specific gravity bunkered at Tampico, Mexico, she operates on an average fuel-consumption of 8.9 tons per 24-hour day and her daily consumption of Vacuum Oil Co.'s lubricating-oil, and 10-gallons of cylinder-oil and 6 gallons of all other oil, including make-up as with the "Handicap."

The engines are controlled from the upper platform, which position seems perfectly satisfactory to her engineers. On some days the speed of this vessel has reached 12 knots, but the average of voyage after voyage is 10.8 knots.

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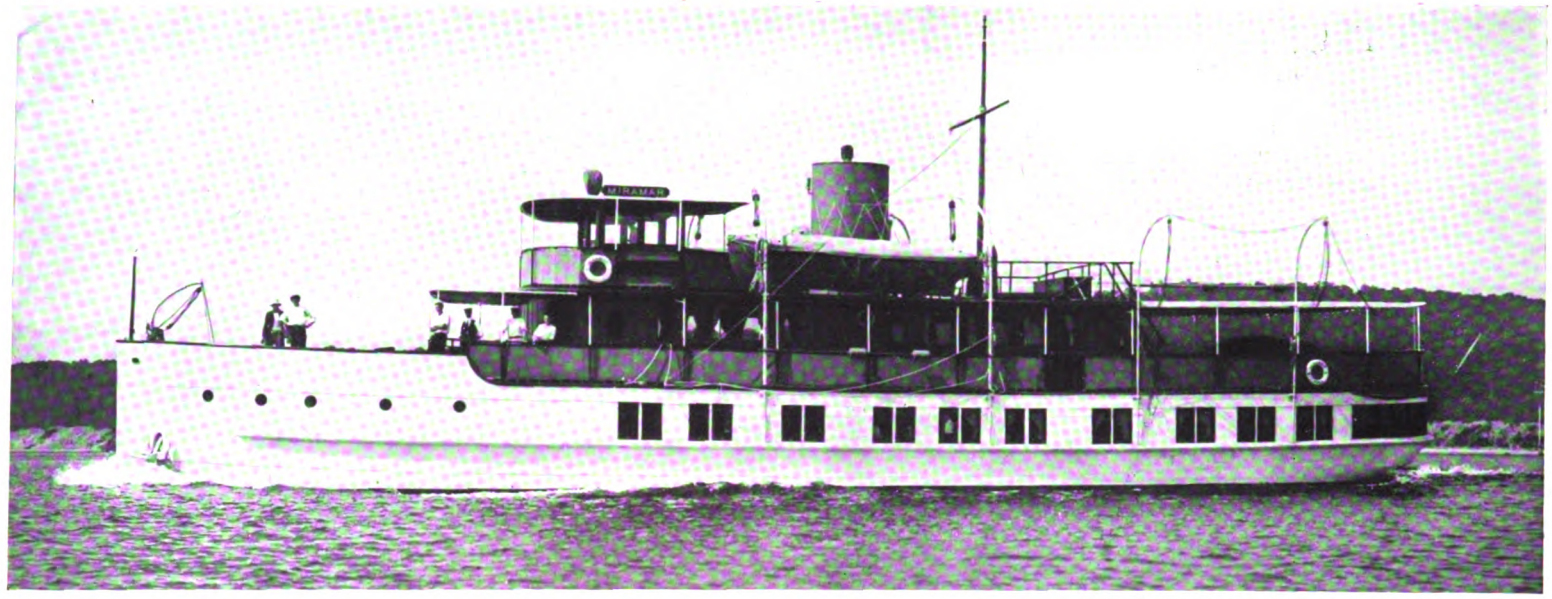


Nelseco-Diesel powered motor house-boat "Miramar" just placed in commission

The aforementioned fuel-consumption covers the fuel for the main-engines and the auxiliary 25 h.p. Vickers-Petter surface-ignition oil-engine which operates the electric-generating set continuously at sea for handling steering-gear, bilge-pump and fuel-oil transfer-pump. The donkey-boiler and other larger Diesel-driven auxiliaries are not operated at sea, but are started upon nearing port so as to provide maximum supply of steam for deck auxiliaries and compressed-air for manoeuvring. It is very seldom that she avails herself of the services of a tug as she handles very readily about docks and Captain Jose Hara Cimiano is delighted with her.

The unfailing regularity of this vessel in making runs from port to port is well illustrated in the following table which gives her voyages from Feb. 22 of this year up to the time of our visit to the ship on June 27th.

Ports	Date Left Former Port	Date Arrived at Latter Port
Newcastle-on-Tyne to Thames Haven	Feb. 22	Feb. 23
Thames Haven to Brunsbuttel, Germany	Feb. 26	Feb. 28
Brunsbuttel to Bilboa, Spain	Mar. 3	Mar. 8
Bilboa to Tampico, Mexico	Mar. 10	Mar. 30
Tampico to New Orleans, U. S. A.	April 1	April 4
New Orleans to Tampico	April 7	April 10
Tampico to New Orleans	April 11	April 15
New Orleans to Tampico	April 19	April 22
Tampico to Colon, C. Z.	April 22	April 29
Colon to Tampico	May 2	May 7
Tampico to Colon	May 9	May 15
Colon to Tampico	May 17	May 22
Tampico to New Orleans	May 23	May 26
New Orleans to Tampico	May 28	May 31
Tampico to Colon	June 1	June 7
Colon to Tampico	June 9	June 14
Tampico to New York	June 19	June 27

In many of the above cases where she was in port more than two days a Sunday occurred on which no loading or unloading of cargo was done; she was always ready to leave the moment the cargo had been handled. Some of these runs were made in bad weather over long distances, the run from Bilboa, Spain to Tampico, Mexico, for inshance, being 4,978 miles, which was made in 20 days at an average speed of 10.3 knots on a fuel-consumption of 186 tons, or 9.3 tons per day. Steam-driven tanker owners should compare their operating costs with those of the "Conde de Churruca".

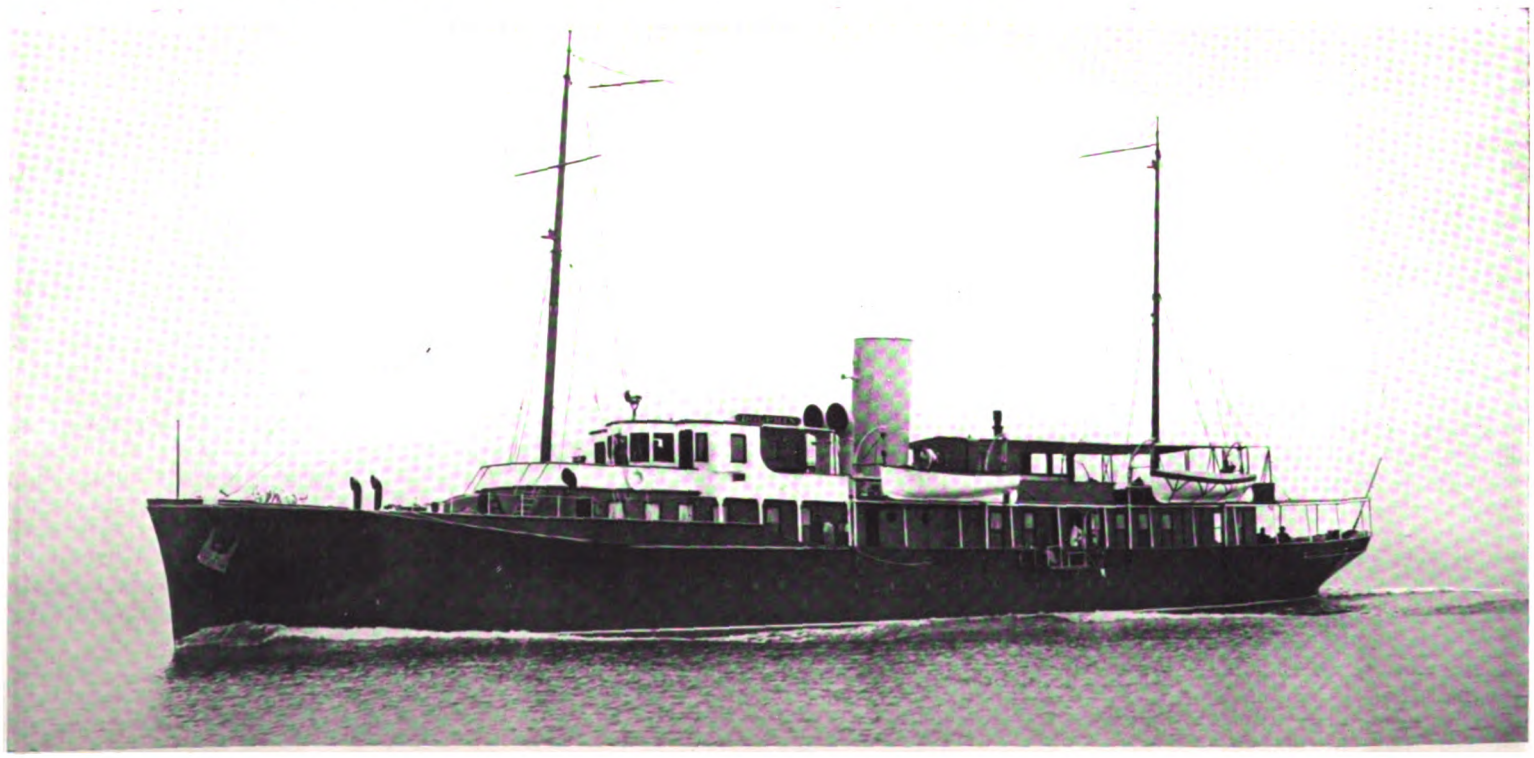
SECTION 11 OF THE NEW SHIPPING BILL

In a contribution to *Nautical Gazette*, Capt. C. A. McAllister, Vice-President of the American Bureau of Shipping made the following statement regarding Section Eleven of the new Merchant Marine Bill.— "It is apparent that the stipulation that the 'most efficient and the most economical machinery' referred to in the bill can only be interpreted in one way, and that is as meaning Diesel engines. The provision therefore means that this fund must be expended in the construction of motorships and in the installing of ships already built with Diesel plants. The law provides this clearly and there can be no swerving from the provisions of the act.

"I regard this clause as being one of the most constructive and one of the most influential features of the bill. It means that this country will possess a fleet of motorships second to none in the world, and with such a mercantile marine we shall be equipped to capture our share of the world's trade to take our rightful place on the seven seas.

"The Bill also provides that loans shall be made from this fund for a period of fifteen years at an interest rate of two per cent. per annum. This will so help to reduce the initial cost of the motorships that foreign nations will not be able to operate their fleets as cheaply as we can. It is in this clause that one of the best solutions to our mercantile marine problems rests, and properly enacted it will have the effect of building up a fleet of which this country can be proud and which other nations will be compelled to respect.

"It will be observed that in this connection a decision must be reached as to what is the most efficient and most economical type of machinery, and this weighty and all-important matter should not be left to the whim of one man."



Mr. Mortimer L. Shiff's new motor-yacht "Dolphin" built by the Newport News Shipbuilding & Dry Dock Co., from Cox & Stevens Designs and powered with twin 500 b.h.p. Winton Diesel engines.

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Pacific Coast Activity in Oil-Engine Work-Boats

WE have often in our pages called attention to the rapidly increasing number of oil and Diesel-engines which are being installed in work-boats—particularly on the West Coast of this country, both in new boats and to take the place of steam or other type of internal-combustion engines. The tremendous savings in fuel-expense which these engines effect cannot be ignored by any work-boat operator and when one oil-engined boat gets into a fleet the leaven is sure to work. A steam tow-boat owner operating his tugs at a cost of $2.50 per hour for fuel alone cannot compete against a Diesel-engined tug costing only a dollar an hour for fuel especially when the latter can do equal work with less crew, no stand-by expense, less time occupied in taking fuel aboard and can leave the dock at a few minutes notice while his steam-tug requires hours.

It is not sentiment which is responsible for this transition to oil and Diesel-engine power; it is only because this power performs equal or better work at less cost. And the cost of doing business is paramount in the mind of the business man today. However striking the present degree of activity, this economic advantage of the motor-driven boat will in time bring about the conversion of the entire fleet to oil or Diesel-engine drive. For there are 75,000 motor-boats on the Pacific Coast and the hundred or so boats which have been equipped with oil-engines during the past year, when this activity has been greatest, is only a beginning. During this past twelve months a total of over 13,000 horse-power involving an investment of nearly two million dollars has been installed; manufacturers of oil and Diesel-engines should well consider the tremendous possibilities for future business which lie before them in this section alone, not to mention the balance of the coast-line of this country where their engines are obtaining a foot-hold. While the physical characteristics and industrial developments on this Pacific Coast have been such that the internal-combustion engine of gasoline, kerosene and distillate types have been a necessity, the era of the oil-engine has already begun.

The extent of the activity of the past twelve months is best noted by glancing at the following list of oil and Diesel-engine installations made on the Pacific Coast, to which we draw the attention and serious consideration of every manufacturer of internal-combustion engines in this country. It is significant and we venture to suggest that twelve months from this date that such a list will occupy twice the space and that the balance of the country will be able to contribute a list of installations of equal length.

The adjacent list, representing 84 individual installations totalling 13,660 horse power, is not to be considered as including every installation made on the coast, as others may have been made which have not come to our attention. Nor is this list representative of the only field for oil and Diesel-engines, as great interest is being manifested on the Atlantic and Gulf coast and on the Great Lakes in this type and a great many installations of Bolinder, Dodge, Fairbanks-Morse, Kahlenberg, McIntosh & Seymour, Nelseco, Ingersoll-Rand, Winton and other Diesel and oil-engines are being made.

Twelve Months' Installations of Oil-Engines on Pacific Coast

Name of Boat	Type of Boat	Make, Type, Number and Power of Engine	Owner
Atlas	Halibut-schooner	55 h. p. Atlas-Imperial Diesel	Peter Wold
A & G		55 h. p. Atlas-Imperial Diesel	Albert Moe
Betty	Cannery-tender	65 h. p. Atlas-Imperial Diesel	San Juan Fishing & Packing Co.
Boxer	Supply Ship	300 h. p. Atlas-Imperial	Bureau of Education
Chas. H. Foster	Fishing-boat	55 h. p. Atlas-Imperial Diesel	Chas. H. Foster
Colon	Tug-boat	55 h. p. Atlas-Imperial Diesel	Oakland Launch & Tug-boat Co.
Lincoln	Trawler	90 h. p. Atlas-Imperial Diesel	Independent Fish Co.
Lark	Freighter	135 h. p. Atlas-Imperial Diesel	Hunt, Hatch & Co.
Herman	Whaler	250 h. p. Atlas-Imperial Diesel	H. Liebes Co.
Halcyon	Tug-boat	125 h. p. Atlas-Imperial Diesel	A. V. Rideout & Co.
Monarch	Freighter	55 h. p. Atlas-Imperial Diesel	Geo. Wright
Rustler	Tug-boat	80 h. p. Atlas-Imperial Diesel	A. E. Anderson
Panama	Tug-boat	125 h. p. Atlas-Imperial Diesel	Oakland Launch & Towboat Co.
Suisun City	Freighter	Two 55 h. p. Atlas-Imperial Diesel	Hunt, Hatch & Co.
Yolo	Freighter	55 h. p. Atlas-Imperial Diesel	Bay & River Dredging Co.
Sea Imp	Tug-boat	55 h. p. Atlas-Imperial Diesel	Capt. A. W. McNealy
	Tug-boat	55 h. p. Atlas-Imperial Diesel	Pacific Tow Boat Co.
	Motor-yacht	Two 140 h. p. Atlas-Imperial Diesel	R. C. Durant
Two boats, un-named	Trawlers	120 h. p. Atlas-Imperial Diesel	Western California Fish Co.
	Tow-boat	Two 55 h. p. Atlas-Imperial Diesel	Panhandle Lumber Co.
	Tug-boat	165 h. p. Atlas-Imperial Diesel	Tacoma Tug & Barge Co.
	Fish-boat	90 h. p. Atlas-Imperial Diesel	Charles Warner
	Tug-boat	55 h. p. Atlas-Imperial Diesel	F. E. Drane
	Tug-boat	37½ h. p. Dodge Hvid oil-engine	J. W. West
Three Sisters	Fish-boat	100 h. p. Enterprise Diesel	Paladini Fish Co.
Gov. Stevens	Inspection-boat	100 h. p. Enterprise Diesel	State Board of Harbor Commissioners
Sequoia	Auxiliary-schooner	75 h. p. Enterprise Diesel	F. A. Watson
Grizzly	Tug-boat	100 h. p. Enterprise Diesel	Frank Nordlund
Lily	Auxiliary-schooner	Two 75 h. p. Enterprise Diesel	Peter Jacobs
	Lighter	90 h. p. Enterprise Diesel	Arroya Vista Lighterage Co.
A. W. Starrett	Freighter	Two 75 h. p. Fairbanks Morse surface-ignition oil-engine	Merchants Transportation Co.
Creosote	Tug-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	Pacific Creosoting Co.
Dorothea	Barge	60 h. p. Fairbanks Morse surface-ignition oil-engine	R. W. Seitz & P. F. Wood
Equator	Tug-boat	200 h. p. Fairbanks Morse surface-ignition oil-engine	Cary-Davis Tow Boat Co.
Advance	Tug-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	Cascade Tug Boat Co.
Elk	Ferry-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	
Alpha S.	Passenger-boat	30 h. p. Fairbanks Morse surface-ignition oil-engine	Kamshak Packing Co.
Blue Sea	Trading-schooner	45 h. p. Fairbanks Morse surface-ignition oil-engine	Olaf Swenson Co.
Argus	Passenger-boat	45 h. p. Fairbanks Morse surface-ignition oil-engine	Frank Bongard
Hustler	Tow-boat	60 h. p. Fairbanks Morse surface-ignition oil-engine	R. J. Ultican
Iskum	Auxiliary-schooner	75 h. p. Fairbanks Morse surface-ignition oil-engine	Phoenix Northern Trading Co.
Fawn	Tug-boat	Fairbanks Morse surface-ignition oil-engine	Tacoma Tug & Barge Co.
Mary Ellen	Cannery-tender	100 h. p. Fairbanks Morse surface-ignition oil-engine	Owned at Everett, Wash.
Margaret S.	Tug-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	American Tug & Towboat Co.
Republic	Halibut-schooner	100 h. p. Fairbanks Morse surface-ignition oil-engine	M. Heggs
Mildred	Barge	60 h. p. Fairbanks Morse surface-ignition oil-engine	Grannan & Sons
Garcia	Service-launch	60 h. p. Fairbanks Morse surface-ignition oil-engine	Owned at Stockton, Cal.
Tourist	Passenger-boat	45 h. p. Fairbanks Morse surface-ignition oil-engine	F. S. Elfving
Pioneer	Ferry-boat	60 h. p. Fairbanks Morse surface-ignition oil-engine	Nichols Bros. & Henderson
Steelhead	Tug-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	Pioneer Towing Co.
No. 7	Tug-boat	200 h. p. Fairbanks Morse surface-ignition oil-engine	City of Los Angeles
Discover	Passenger-boat	60 h. p. Fairbanks Morse surface-ignition oil-engine	Hoods Canal Short Route
Seal	Freighter	60 h. p. Fairbanks Morse surface-ignition oil-engine	Owned at Seattle, Wash.
Osprey	Tug-boat	100 h. p. Fairbanks Morse surface-ignition oil-engine	Foss Tow Boat Co.
	Dredger	60 h. p. Fairbanks Morse surface-ignition oil-engine	Conaway Ranch Co.
	Motor-yacht	Two 200 h. p. Fairbanks Morse surface-ignition oil-engine	Powell River Lumber Co.
Two boats	Lighthouse-tenders	100 h. p. Fairbanks Morse surface-ignition oil-engine	Victoria Dept. of Marine & Fisheries
	Motor-yacht	75 h. p. Fairbanks Morse surface-ignition oil-engine	Owned at Vancouver, B. C.
		30 h. p. Fairbanks Morse surface-ignition oil-engine	J. M. Johnson, Portland, Ore.
		30 h. p. Fairbanks Morse surface-ignition oil-engine	Oscar Anderson
Two boats, un-named	Fish-boats	45 h. p. and 100 h. p. Fairbanks Morse surface-ignition oil-engines	Coast Fish Co.
	Cannery-tender	60 h. p. Fairbanks Morse surface-ignition oil-engine	Warren Packers Ass'n.
	Fish-carrier	100 h. p. Fairbanks Morse surface-ignition oil-engine	Western California Fish Co.
Suquamish	Passenger-boat	125 h. p. Gulowsen-Grei surface-ignition oil-engine	Kitsap County Transportation Co.
Convention	Halibut-schooner	60 h. p. Kahlenberg surface-ignition oil-engine	Antone Ulla
Idle Hour	Motor-yacht	36 h. p. Kahlenberg surface-ignition oil-engine	Karl Rathfon
	Cannery-tender	75 h. p. Kahlenberg surface-ignition oil-engine	Owned on Puget Sound
	Fish-boat	36 h. p. Kahlenberg surface-ignition oil-engine	British Columbia Canners, Ltd.
	Fish-boat	36 h. p. Kahlenberg surface-ignition oil-engine	Ferrier & Lucas
Roy B.		100 h. p. Skandia surface-ignition oil-engine	N. Fay & Son
Dolly C.	Tug-boat	150 h. p. Werkspoor Diesel	Cary-Davis Tow Boat Co.
Penguin	Tug-boat	200 h. p. Werkspoor Diesel	E. V. Rideout
Galvez	Excursion-boat	200 h. p. Werkspoor Diesel	Capt. Dalehite
Vaquero	Cattle-boat	250 h. p. Werkspoor Diesel	Vail Co.
Charlie Watson	Tanker	Two 550 h. p. Werkspoor Diesel	Standard Oil Co.
H. T. Harper	Tanker	Two 850 h. p. Werkspoor Diesel	Standard Oil Co.
Golden Gate	Ferry-boat	Two 500 h. p. Werkspoor Diesel and Electric Drive	Golden Gate Ferry Co.
Sister-ship to above now completing.			
Just ordered	Tanker	Two 400 h. p. Werkspoor Diesel and Electric Drive	Standard Oil Co.
Glencove	Freighter	100 h. p. Western Diesel	Herringer & Scott
	Motor-yacht	Two 135 h. p. Winton Diesel and Electric Drive	G. Allen Hancock

There are 10 Pacific-Werkspoor Diesels of 850 b. h. p. each, in storage and not yet installed, owned by the U. S. Shipping Board, and there are some Atlas-Imperial installations not recorded above.

LILLICO TOW BOAT COMPANY PLANS SEVERAL CONVERSIONS TO DIESEL-POWER

CAPT. ROY LILLICO, of the Lillico Launch & Tow Boat Co. of Seattle, recently made an extensive trip investigating Diesel-tugs in actual operation to supplement his study of this type. Upon his return to Seattle it was announced that the company would install Diesel-engines in the "Lillico 20" and "Arab," both 65 ft. long. The former is an ex-government tug which was used during the war hauling spruce from Coos Bay to Astoria, Oregon, and is now used on outside work. The latter craft is used off the coast of Washington and British Columbia and will be powered with a 165 H.P. Diesel-engine. Final decision as to the particular make has not been reached.

In addition to these two tugs four other work-boats will be converted from gasoline to Diesel-power and a new tug to be powered with a 600 to 800 H.P. Diesel-engine will be built, so that the Lillico company will operate seven Diesel-tugs if their present plans are carried out. Capt. Lillico has long recognized the superiority of oil-engines, but business conditions have prevented his taking the step he now plans.

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Winton Diesel-driven tug "F. H. Anson."

SPLENDID PERFORMANCE OF WINTON DIESEL TUG

On page 196 of our March issue we published plans of the new motor-tug "F. H. Anson" built by Robert J. Morrill of Collingwood, Ont., from designs by Ralph E. Winslow for the Abitibi Power and Paper Co., of Montreal, Canada. This tug is now in operation in the wilderness of Northern Ontario towing great booms of paper-pulp logs on the Abitibi River, these booms containing from 2,500 to 3,500 cords. It will be remembered that this tug is 83 ft. long, 20 ft. breadth and 9 ft. 6 in. draft and is powered with a six-cylinder 12 15/16 in. by 18 in. Winton Diesel engine which is proving perfectly satisfactory in heavy towing service. This swings a four-blade bronze propeller of 6 ft. 6 in. diameter and 4 ft. 6 in. pitch at from 40 to 260 r.p.m. when light and from 40 to 208 r.p.m. when towing. When running light the speed is 13 miles per hour, while towing the huge rafts of logs the speed is one mile an hour.

These rafts are about one-half mile long and about 800 ft. wide; towing such huge rafts is only possible because of the power of the Diesel engine, as in the first six days of operation 14,500 cords of pulp wood were delivered to the mill by the "F. H. Anson," which the company officials state was more than their three steamers delivered in ten days of last year. In fact, this tug handles rafts containing more logs than can be used, so that the original plan of operating 24 hours per day with two shifts of crew has been abandoned.

Her fuel-consumption at various revolutions and horsepower is as follows: at 260 r.p.m., corresponding to 375 h.p., 24 gals. per hour; at 196 r.p.m., corresponding to 300 h.p., 22 gals. and when towing at 176 r.p.m. delivering 287 h.p. the consumption is 18.5 gals. Her owners state that she handles perfectly and is satisfactory in every way. She is proof of the value of Diesel-power for tug-boats.

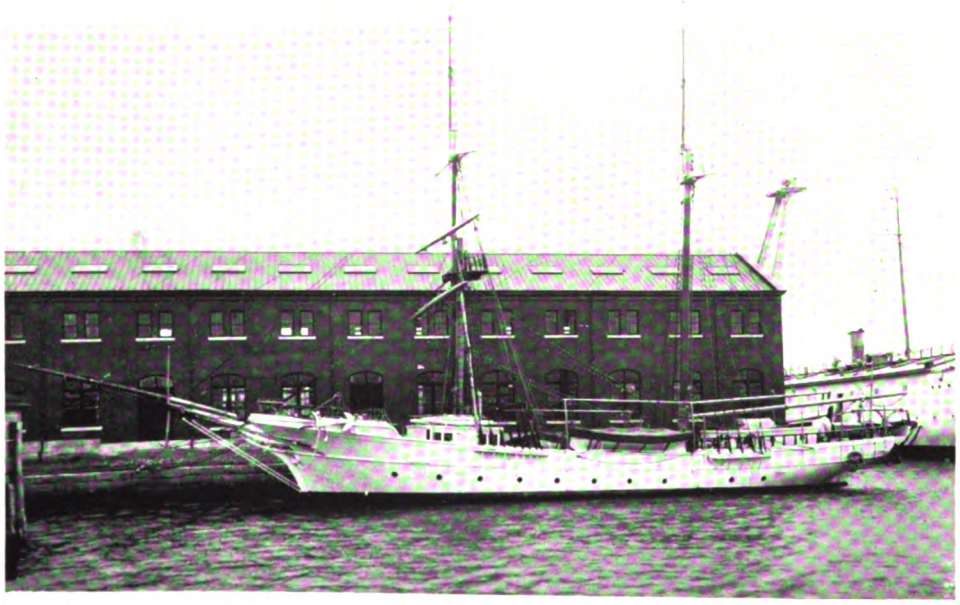


Photo courtesy U. S. Navy Dept.

The "Boxer," which is being converted by the Bureau of Education of the Department of the Interior to Atlas-Imperial Diesel power.

U. S. S. "BOXER" TO BE DIESEL POWERED

Former Naval Academy Training Ship Being Equipped for Service in Alaska

Many an officer of the United States Navy owes much of the training which he received when a cadet at the Naval Academy to the cruises aboard the "Boxer", which up to this time has been a splendid example of the brigantine type of sailing-vessel. She was built at the Portsmouth Navy Yard in 1905 and is 125 ft. long, 29 ft. 9 in. breadth, of 9 ft. 2 in. depth and is capable of carrying 450 tons.

Because of the need of a staunch, seaworthy vessel to carry supplies, teachers, physicians, nurses, etc. from Seattle to the out-of-the-way villages of Alaska the "Boxer" has been transferred from the Navy Department to the Bureau of Education of the Department of the Interior. The work of this bureau is exceedingly important, not only hundreds of lives but the main source of food and fuel depending upon the maintenance of communication, which requires the utmost reliability and ruggedness of construction.

An appropriation has been voted by Congress to cover the cost of installing a Diesel-engine in the "Boxer", illustration of which we are enabled to publish by courtesy of the U. S. Navy Department. A 300 h.p. Atlas-Imperial Diesel-engine has been purchased and a contract signed for its installation, upon the completion of which this Fall the vessel will go into service under the direction of W. T. Lopp, Chief of the Alaska Division of the Bureau of Education, at Seattle, Wash.

NEW MOTORSHIP "TRINACRIA" RE-NAMED "ERLAND"

On page 544 of our July issue we referred to the launch of the Swedish motorship "Erland" and on the previous page it was stated that the "Trinacria" had been sold by the Swedish Lloyd to other shipowners. This is the same vessel, having been re-named shortly after the launching, by the new owners the Tirfing Steamship Co. of Göteborg, also a Dan Brostrom concern and which already owns the 8,200 tons, 2,800 i.h.p. motorship "Hemland." Reference to the "Erland" also was made on page 218 of our March 1921 issue before she was named when her costs were compared with a sister steamer.

Installed in the "Erland" is a six-cylinder long-stroke Burmeister & Wain type Diesel engine built under license by the Götaverken of Göteborg who also built this vessel's three auxiliary Diesel-electric sets, two of 75 b.h.p. and one of 50 b.h.p. We believe that the "Erland" is the first large single-screw motorship to have a cruiser stern. There are ten derricks served by seven electric winches. The "Erland," by the way, should not be confused with the new German motorship "Emland."

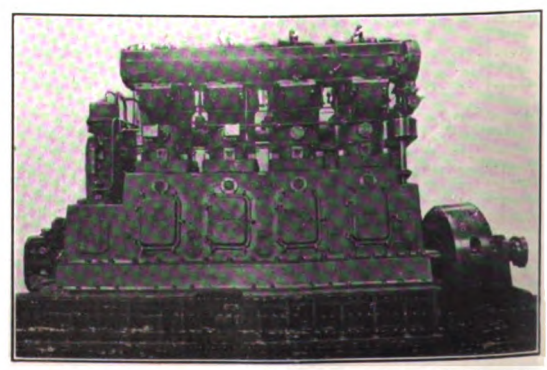
A DANISH TWIN-SCREW MOTOR-FERRY

Holeby Diesel-Engined Passenger and Automobile Ferry at Mommark

INTEREST in Diesel ferry-boats appears to be keen at this time, as the pages of this issue of MOTORSHIP indicates. Nearly a dozen Diesel and Diesel-electric ferries are either just going into service or are in the design-stage in this country, while abroad there is considerable activity. Since the return of Northern Schleswig to Denmark ferry-companies have been interested in supplementing the services of the Danish State Railway steam-ferries and one of these private concerns is the Mommark Ferry Co., in which the East Asiatic Co. is financially interested. While the hot-bulb type of oil-engine has previously been installed in Danish motor-ferries, Holeby Diesel-engines are being installed in the Mommark ferry, which was launched on June 24th, at the Nakskov Shipyard, Nakskov, Denmark. She is of the following particulars:

Length over all	140' 0"
Breadth	34' 6"
Depth	14' 4"
Capacity, passengers	400
Capacity, automobiles	20
Power	550 shaft H.P.
Speed loaded	11 knots

Two four-cylinder, four-cycle 275 h.p. Holeby Diesel-engines of 400 mm. (15.7 in.) bore and 550 mm. (21.6 in.) stroke will drive this ferry by means of bronze reversible three-blade propellers of 1,900 mm. (74.8 in.) diameter made by Meissner, the engines not being reversible.



One of the 275 h.p. Holeby Diesel Engines of the Mommark Ferry.

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Interesting Notes and News from Everywhere

THE Valvoline Oil Co. of Edgewater, N. J., is operating the 100 h.p. Fairbanks Morse engined tug and lighter *Magic Safety* in New York harbor.

The Motorfabrik Deutz of Köln Deutz, Holland, have purchased the Rotterdam Shipbuilding Co's. yard at Kralingsche Veer.

Delivery of a Froude dynamometer to test Diesel engines of 1,550 b. h. p. at 75 r. p. m. has been made to Cammell Laird & Co., Birkenhead, England.

Emma Biesterfeld, a motor-freighter of 650 tons d. w. was recently launched from the Janssen & Schmilinsky shipyard, Tollerort, Germany, to the order of the Biesterfeld Shipping Co. of Hamburg.

Italy has just completed a concrete motorship, namely the 300 tons deadweight *Perseveranza,* recently launched at Lavagna, near Genoa. She has twin oil-engines and auxiliary canvas.

Now being refitted at London for service in the Solomon Islands is the old American-built schooner *Laumona,* propelled by twin 180 b. h. p. Bolinder oil-engines that were installed during the war.

Kraal & Abeelen of Rotterdam, Holland, have taken delivery of a new 103 ft. cattle-boat in which two 40 b. h. p. Brons oil-engines are fitted. The vessel was built by the De Liesbosch Shipyard & Engine Works, Utrecht.

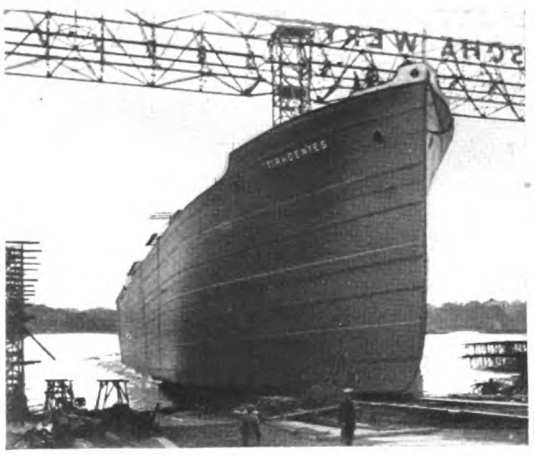
On June 17th there was launched at the yard of the Consolidated Shipbuilding Corp. the 125 ft. Nelseco Diesel-engined steel house-boat *Zalophus,* which is being constructed for John Ringling, of the circus-management of that name from designs by Henry J. Gielow of New York.

A license to construct the Cammellaird-Fullagar opposed-piston type oil-engine for stationary purposes has been acquired by Carel-Freres of Ghent, who it will be remembered were one of the licensees of Dr. Rudolf Diesel, having purchased rights in 1893.

It has been necessary to hold over until next month the continuation of Mr. Madsen's article on Actual Running Costs of Motorships, and the conclusion of Admiral Goodwin's article on Diesel Development in the British Navy. The final installments of both articles will be given in the September issue of MOTORSHIP.

Richardsons—Westgarth, Ltd., who recently entered into arrangement to construct Beardmore-Tosi engines and who are building four Diesel engines for two twin-screw motorships for Furness-Withy, recently set aside $225,000 for the purpose of equipping their Diesel-engine department.

Another launching of a Diesel-engined motor-yacht took place at the yard of Geo. Lawley & Son, Neponset, Mass., during June, this being the *Colleen,* built from designs by B. T. Dobson of New Bedford, Mass., for Samuel A. Savage of New York. She is 115 ft. long and is powered with two 150 h. p. Winton-Diesel-engines.



Launch of motorship "Tiradentes" at the Deutsche Werft, first of three 8,000-ton vessels ordered by Wm. Wilhelmsen. Two A.E.G.-Burmeister & Wain 1,500 i.h.p. Diesels are being installed

Now under construction at the North British Diesel Engine Works is a 3-cylinder double-acting, two-cycle Diesel engine of 2,000 shaft h. p. at 100 r. p. m. The cylinders are 24½" bore by 44" stroke. The design of this engine was based on experiences dealing with the trials of a 450 shaft h. p. marine unit.

Trials were recently run of the third 11,000 tons motorship to be accepted by Lamport & Holt from McMillan & Sons, the builders. As in the case of the other two vessels she is propelled by twin 2,000 i. h. p. Harland & Wolff-B. & W. Diesel engines.

The Netherlands Shipbuilding Company who last year built the Werkspoor Diesel motorships *Geisha* and *Indra,* both of 6,870 tons d.w. each, also the Diesel-electric submarine mother ship "Pelikaan" of 2,300 tons, made a profit of 1,485,206.19 guilders. A dividend of 8 per cent was paid.

There was launched on Friday, June 2nd, at the yard of the Deutsche Werft, Hamburg, Germany, a sister-ship to the *Isis,* which was illustrated on page 442 of the June issue of MOTORSHIP. She was christened *Osiris,* and will be equipped with two 1,700 h. p. A. E. G.-Burmeister & Wain Diesel-engines and is owned by the Kosmos Line of Hamburg. She will carry 7,500 tons and is 398'-2" length, 53'-11" breadth and 38'-3" depth.

A new steel passenger and freight motor vessel for service on the Mississippi River at New Orleans is being designed by Edwin C. Bennett of New York. This vessel is to be 94 ft. long and will be powered with Diesel-engines driving propellers operating in tunnels. Bids have been obtained and it is expected that construction will shortly be commenced.

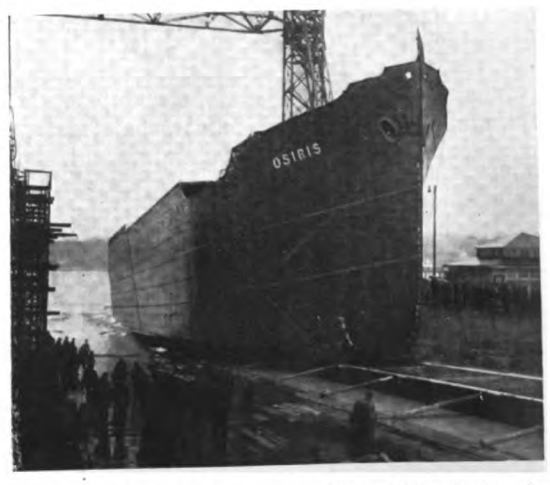
There are now nine American Diesel-electric driven vessels, namely the *Mariner, Fordonian, Guinivere, Valejo, Elfay, Alcyone, Poughkeepsie,* and the two Golden Gate ferries nearing completion. Also the Standard Oil Co. of California have just ordered a Diesel-electric tanker.

An order for a motorship of approximately 1,500 tons d. w. has been received by J. & G. Kincaid of Greenock, Scotland. The vessel will be fitted with a 850 shaft h. p. long-stroke Burmeister & Wain type Diesel-engine which they will build under sub-license from Harland & Wolff. The name of the owners has not been given out.

The new Augsburg M. A. N. Diesel engine of the twin-screw 9,000 tons motorship building for the Hansa Line of the Weser Shipyard, Bremen, are of 6-cylinders 27.559" bore by 47.244" stroke, developing 1,600 shaft h.p. at 100 b. p. m. with a mean-effective pressure of 75 pounds per sq. inch. It is of the four-cycle single-acting crosshead type.

Work will shortly be started at the engine-plant of a well known New York ship-repair yard on an 800 horse power Whaley marine oil-engine. The yard in question has not adopted this design, but is to build the engine under contract. The Whaley engine was described and illustrated on page 18 of our issue of August 1918.

Launch of the motorship "Erland" at the Eriksberg Yard, Göteborg, Sweden.



Launch of the 6,800-ton motorship "Osiris" for the Roland Line at the Deutsche Shipyard, Hamburg.

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We record with sincere regret the death of D. B. Faris, Manager of the Marine Department of the Westinghouse Electric & Mfg. Co. Mr. Faris succumbed to heart failure while at his desk on July 10th. He was much beloved by all his business associates and had the development of the American merchant marine at heart.

Trials were run during the middle of June of the submarine mother ship *Pelikaan* built for the Royal Dutch Navy by the Netherland Shipbuilding Company. This vessel has previously been referred to in MOTORSHIP and is Diesel-electric propelled. She is of 2,300 tons displacement and electricity is generated by twin 700 b. h. p. Diesel engines.

Now having her 100 h. p. Fairbanks Morse surface-ignition oil-engine installed at the dock of the Munson Steamship Line in New York is a new wooden tow-boat 60 ft. long and 19 ft. beam which has just been constructed for them by the Vinyard Shipbuilding Co., of Milford, Del. She will be sent down to Cuba, where the Munson Line already has in operation three other Fairbanks-Morse oil-engined tugs, i. e., *Munevitas, Caibarien* and *John T. Hughes.*

Trials of the Transatlantic Steamship Company's new motor-tanker *Oljaren* were run on June 2nd. This vessel has previously been referred to in MOTORSHIP and was built by Götaverken. She is equipped with two Götaverken-B. & W. built engines of 1,300 i. h. p. and is of 7,500 tons d. w. The cargo pumps are driven by electricity, as well as all the auxiliary machinery.

Another oil-engined fishing-schooner, the *Ruth Mildred,* owned by Capt. John R. Erickson of Brooklyn, N. Y. has gone into service. She is 92 ft. long, 21 ft. breadth, 8 ft. depth, and her 60 h.p. Fairbanks-Morse surface-ignition oil-engine, turning a 44" by 26" propeller, recently drove her around from Gloucester, Mass. to Brooklyn, New York harbor, on her trial-trip in a very satisfactory manner.

Bellowes & Squires, one of the largest owners of Menhaden fishing vessels, of Ocrans, Va., state that they operate five oil-engined boats at the cost of only two steam-vessels in this work. Not only is the economy so much greater but the crews like the motorships because of the work being easier; with the coal-burning steamers of the fishing-fleet the coal is delivered on the dock and all hands have to turn to and bunker the ship, while a hose bunkers the motorship with very little attention on the part of a man or two. A number of Fairbanks-Morse oil-engines are fitted in their boats.

The following Diesel engines built for the Shipping Board now remain on hand at Alameda, Calif., Hog Island, Pa., and South Norwalk, Conn.:

5 McIntosh & Seymour of 750 shaft h.p. each.
10 Pacific-Werkspoor of 825 shaft h.p. each.
2 McIntosh & Seymour of 900 shaft h.p. each.
2 Bolinders of 320 h.p. each.

Details can be obtained from Sidney Henry, Director of Sales, U. S. S. B., E. F. C., Navy Bldg., 19th & B Streets, Washington, D. C.

Chief-Engineer Oscar Olsen of the Motorship *William Penn* recently severed an artery in his arm thro' being cut by a steel chip from a pneumatic hammer. However, we are glad to say that he has entirely recovered, altho' he was in the hospital in Honolulu for three days during which period the vessel was delayed in port, waiting for him. On the run from New York to Honolulu the mean speed was 11.39 with 29' 2" deaft, but the average from Honolulu to Yokohama in bad weather was 10.66 knots. This gives an average speed of a little over 11 knots from New York to Yokohama.

There has been built by B. Hegge, Kiel, Germany, for service between Fünen and the mainland of Denmark a motor-ferry which carries about 200 persons as well as automobiles, live stock, and general cargo. She is of the usual ferry-boat form 90 ft. long, 25 ft. breadth and 6 ft. 6 in. draft, the engines being located amidships under the main-deck. Each engine is a two-cylinder 100 h.p. Calleson oil-engine driving the propeller direct, there being one engine for each propeller. These engines together with passenger cabins and crew's quarters are under deck, while above the main-deck is a cabin and pilot-house. A speed of 8.5 knots is attained because of the light displacement of this ferry. A steam ferry-boat to handle a similar service would require to be 1½ times the displacement of the motor-ferry with a considerable increase of power required to attain the same speed.

Successful trial-trips of the motorship *Aegir* were run on June 1st and 8th from the Deutsche Werke, Wilhelmshaven, Germany. She was formerly a steam-engined warship, and has been converted into a freighter particularly for the transportation on deck of railway-engines from Germany to Russia, for which service she is well suited because of her great initial stability and breadth of beam. On a displacement of 3,450 tons she carries 2,000 tons deadweight on a length of 259 ft. 3 in., breadth 50 ft. 7 in. and 19 ft. 7 in. depth, her draft being 14 ft. 8 in. when loaded. Her two 260 h. p. Diesel-engines, which were formerly constructed for use in submarines, operated satisfactorily on the trials, on which she attained a speed of nine knots. She is a sister-ship of the *Odin* recently reconstructed by the same yard for the same owner, Adolf Bernstein of Hamburg, which also is used for locomotive transportation. See page 194, March, 1922.

EIGHT THOUSAND TON MOTORSHIP WITHOUT STEERING-ENGINE

WHEN one of the 8,000 ton Diesel-powered freighters now building by the Deutsche Werft, Hamburg, for the Hamburg-American Line goes into service she will be unique among motorships, for she will have no steering-engine. She will be steered by a new type of rudder invented by Director Flettner, who recently demonstrated his device in the Hamburg shipbuilding trial tank. The first rudder of this type was installed about a year ago on the small Dutch steamer "Frigido" plying reguarly between London and Rotterdam and has proven satisfactory under severe service, even in Winter storms on the North Sea, and the vessel has navigated among the crowded shipping of the River Thames with perfect control. The installation on the Hamburg-American Line's motorship will be the first on a large seagoing vessel, however, and the record of this new system will be closely watched.

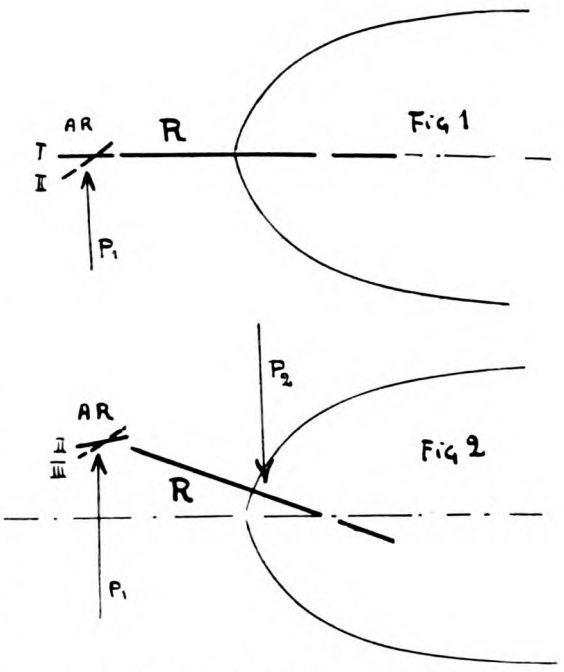

Diagram of Flettner Patent Rudder.

No steam or electric steering-engine is required, the rudder being operated with slight expenditure of effort by a simple device which utilizes the pressure of the water passing same. At the aft end of the main rudder there is a small assistant-rudder which is moved by a gear connected to the steering wheel in the pilot-house. By referring to the diagram this rudder will be noted at the extreme left and it will further be evident that if this small blade is moved from the longitudinal position I to the oblique position II that the pressure of the water P_1 acts upon it in the direction indicated by the arrow in Fig. I, which pressure moves the main-rudder to a certain position as shown in Fig. 2 until the moment of the pressure P_1 is balanced by the moment of the pressure P_2 which acts upon the main rudder-blade.

Further movement of the assistant-rudder to III will be followed by further movement of the main-rudder. The power required to turn the assistant-rudder is quite small because the pressure P_2 is much greater than P_1 as its lever is much smaller, especially if the rudder is of the balanced type. If the assistant-rudder is of the balanced type the pressure P_2 will serve for steering ships having an unbalanced rudder. In fact, it has been determined that only 5—20 per cent. of the normal power is necessary to operate rudders on this system, the exact amount depending upon whether main and assistant rudders are of the balanced type or not. The gear needed to operate this rudder is small, simple and can be made very heavy to withstand all stresses coming upon it.

The new motorship "Arizona" shortly after the successful launching ceremony.

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